Canada. Dept. of Communications.

Telecommunication Studies. 1971,

2d-2i.

Canada. Communications department

5800

TELECOMMISSION STUDY 2(D)

COMMUNICATIONS

AND

REGIONAL DEVELOPMENT

Available by mail from Information Canada, Ottawa,
and at the following Information Canada bookshops:

HALIFAX
1735 Barrington Street

MONTREAL
1182 St. Catherine Street West

OTTAWA
171 Slater Street

TORONTO
221 Yonge Street

WINNIPEG
393 Portage Avenue

VANCOUVER
657 Granville Street

or through your bookseller

Price $1.00 Catalogue No. Co41-1/2D

Price subject to change without notice

Information Canada
Ottawa, 1971

This Report was prepared for the Department of Communications by a project team made up of representatives from various organizations and does not necessarily represent the views of the Department or of the federal Government, and no commitment for future action should be inferred from the recommendations of the participants.

This Report is to be considered as a background working paper and no effort has been made to edit it for uniformity of terminology with other studies.

FOREWORD

This report has been prepared by a project team consisting of representatives drawn from the telecommunications industry and from agencies of the Federal and certain Provincial Governments. The need for this type of study was proposed to the Department of Communications by Mr. K.V. Cox, who had, as President of New Brunswick Telephone Company, become personally aware of the importance of telecommunications as a factor in regional economic development and also of the difficulties encountered by a telecommunications carrier operating in a region which has experienced a restricted economic growth. This subject was approved as one of the studies to be undertaken by the Telecommission and a project team was subsequently formed to undertake the study and prepare a report.

As in the case of most reports developed and prepared through the project team or committee approach, the greater part of the drafting was made the responsibility of a few individuals. Some of the points of view presented here draw heavily upon the experience of the N.B. Telephone Company which has also provided most of the statistical material in the latter part of the report. While there was not complete unanimity among all members, a substantial degree of agreement has been achieved. Needless to say, however, the report does not necessarily reflect the positions of the organizations, governments or departments represented by members of the project team which are listed as follows:

Mr. W.T. Armstrong	Canadian Broadcasting Corporation
Mr. K.V. Cox	New Brunswick Telephone Company
Mr. David Darlington	Province of Prince Edward Island
Mr. D.E. Foohey	Department of Manpower and Immigration, Ottawa
Mr. Gordon Haase	Department of Communications, Ottawa
Mr. E.E. King	Department of Communications, Ottawa
Mr. R.F. Latham	Bell Canada, Montreal
Miss Zilpha Linkletter	Province of Nova Scotia
Mr. K.J. MacDonald	Canadian National Telecommunications
Mr. I.H. Midgley	Department of Regional Economic Expansion, Ottawa
Mr. N.G. Mulder	Province of New Brunswick
Mr. Z. Sametz	Province of Newfoundland
Mr. Hugh Seadon	Québec Téléphone
Mr. E.D. Thompson	New Brunswick Telephone Company

CONTENTS

LIST OF ATTACHMENTS

PART I INTRODUCTION

1.1 This study examines the relationship of telecommunications to economic disparities and regional development in Canada and it is one of a program of studies being undertaken by the Telecommission. The term "telecommunications" as defined elsewhere is understood to include any transmission, emission, or reception of signs, signals, writing, images or sounds or intelligence of any nature by wire, radio, visual or any electromagnetic system. In general, the telecommunication industry is taken to include the sub-industries consisting of telephones, telegraphs, broadcasting and cable television and for purposes of this study includes the supporting telecommunication manufacturing industries.

1.2 In a review of the subject matter project team members noted with concern the obvious lack of statistics and analyses relating to telecommunications as an element of regional development. Except for isolated case studies in other nations there appears to be no well developed body of literature on the topic. In a review of Canadian literature the importance of telecommunications as a contributing factor to regional development was found to be lacking except by inference. As one member observed, this might be explained by the fact that in Canada we have enjoyed a high quality of telecommunications services. Because it has been supplied, for the most part, on a principle of service on demand, we have become complacent in our attitudes towards the role of telecommunications as an instrument of regional development or as an instrument of social and economic development per se.

1.3 The present study sets out to break this simplistic diagnosis and in doing so we examine two main aspects of the relationship

between telecommunications and regional development. First, given the vast expanses of Canada, importance of economic growth as a national goal, and major thrusts by the federal government in regard to regional expansion, there is the question of the adequacies of regulation with respect to telecommunications plant and capital requirements to support accelerated regional economic growth. Second, there is a need to ensure that new telecommunications policy will be consistent with existing policies directed towards the reduction of economic disparities and with overall economic and social objectives of the Government of Canada.

1.4 As for procedure, the first part of the study sets out in a descriptive manner the nature of regional economic disparities within Canada. Included in this are the interrelationships among factors affecting regional economic disparity such as location, resource use, population, labour force characteristics, infra-structure and current government policy.

1.5 This is followed by a comparative examination of current telecommunications development with that of national and regional development. Aspects dealt with include the substitution of capital for labour in the telecommunications industry as it relates to regional employment, the influence of regulatory policy on the factor mix on a regional basis, the importance of efficient telecommunications in the overall regional development process and an examination of the current economic and social costs of telecommunications development on a regional basis. An examination is also made of the future developments of telecommunications and the manner in which these developments will complement or conflict with regional growth.

1.6 Finally, public telecommunications policy is considered having regard for past experience and anticipation of future requirement.

PART II THE NATURE OF REGIONAL DISPARITIES

Regional Disparities Persist in Many Countries

2.1 In many of the advanced industrialized countries, increasing attention has been paid in recent years to regional economic disparities and the problems of regional development. A systematic relationship has been found to exist between national development and regional inequality. The degree of regional inequality is very high in middle-income countries, but consistently lower as we move to higher levels of development.(1)

2.2 It is not surprising to find a nation's economic growth to be centred, for a time at least, on certain favoured regions, with other regions lagging behind. At each step of development, the regions that have been favoured up to that point have certain advantages over other regions in competing for a share of new economic activity. Having a disproportionate share of growth industries, characterized by expanding employment and high earnings, these regions tend to have large, growing, skilled and affluent populations. Therefore, they are usually the best domestic markets for most products, and, having large local markets they are also favoured as transshipment points, a factor which tends to give them easier access to foreign as well as domestic markets. There are in these regions more jobs for educated and skilled workers and better opportunities to acquire further education and skill. Such regions have a large

---

(1) See Williamson, Jeffrey G., "Regional Inequality and the Process of National Development: A Description of Patterns", Economic Development and Cultural Change, Vol. XIII, No. 4., Part II, July 1965.

and growing pool of skilled labour with which to attract new industry, and the presence of educational facilities and other social amenities promotes further growth. On account of their large volume of economic activity, these growth regions are likely to be in a relatively strong position to provide new plants and new industries with the ancillary services they require. Because they have established a record of growth and prosperity, the people of these regions, as well as potential investors, are likely to be optimistic about the region's future. Thus, entrepreneural talent, professional expertise and investment funds are likely to be available.

2.3 In Canada the vastness of the country and its great diversity of widely scattered natural resources has given rise to a relatively small number of population concentrations that are separated by large and sparsely settled tracts of land. Historically, our narrow and disjointed settlement configuration, combined with difficult physical barriers, has made for high costs of inter-regional movement of both goods and people. Our settlement of population has been marked by the arrival at different times of persons with diverse cultures and traditions, who often have settled in a particular region. Our federal form of political organization, a symptom of these regional differences, has sanctioned the development of strong regional authorities, each being primarily concerned with regional interests.

2.4 It is interesting to note that among the most developed nations in the world, the United States, Canada and Sweden all have serious regional inequalities. These three nations have large land masses. It appears that the greater the geographic size, the larger the scope for

wide regional variations in natural resource endowment, the weaker the linkages between regions and the stronger the incidence of localism.

2.5 Available information on regional inequalities, in per capita income over any extended period of time, is confined to Brazil, Canada, France, Germany, Italy, Sweden and the United States. What information we have for these countries suggests that increasing regional inequality is generated during the early development stages, while mature growth has produced regional convergence. (1) Between the 1920's and the late 1930's, Canada does not reveal a trend either to convergence or divergence. Increasing inequality during the 1930's reflects the severe incidence of the great depression on the Prairie Provinces, and the subsequent convergence reflects in part a movement away from abnormal conditions and in part a decentralization of activity under wartime conditions. Over the past decade there has been some further decline in regional inequality.

Regional versus National Growth

2.6 It is generally recognized that the growth rate of the income, or national product of the nation, is related to the nature of the inter-regional distribution of income. The exact nature of this relationship, however, is the subject of some controversy. To some extent the differences in viewpoint among economists stem from differences in their appraisals of effectiveness in the organization and functioning of competitive market forces. On the one hand, it has been argued that government efforts to encourage industry to locate in lagging regions distort the most efficient allocation of labour and capital in the economy

---

(1) Williamson, op. cit.

that would be normally brought about by the free play of market forces. For example, the Economic Council of Canada, in its Fifth Annual Review: The Challenge of Growth and Change, point out that a shift in resources from higher- to lower-income regions frequently represents a shift of resources away from regions with highly viable bases and results in a retardation of the rate of national economic growth.(1)

2.7 On the other hand, it has been argued that failure to rectify regional imbalances in Canada has resulted in the Gross National Product being less than it might be. Professor Higgins has countered the Economic Council's statement on this issue as follows:(2)

> Failure to attack directly the problem of regional disparities is the nub of Canada's poor economic performance. It is precisely an integrated federal and provincial policy for reducing regional gaps that will do most to push the Canadian "Phillips Curve"(3) downward to the left, permitting higher rates of growth and reduced unemployment without inflation. Even the richer regions will then enjoy faster rates of growth in per capita income than will be possible without a national policy for regional development.

Professor Higgins' argument is related to a situation in which production in the more highly developed areas is limited by labour shortages. As such shortages are apt to be most acute among skilled workers, the question arises as to the impact on the less highly developed areas of the loss of skilled labour needed by the more highly developed.

---

(1) Ottawa, Queen's Printer, 1968, pp. 178-79.
(2) Higgins, Benjamin, "The Economic Council of Canada: Fifth Annual Review", Canadian Tax Journal, Vol. XVI, No. 5, September-October 1968, pp. 348-49.
(3) The Phillips Curve relates levels of unemployment to associated rates of price increase.

Measurement of Regional Disparities in Canada

2.8 Since geographic regions can be delineated to include any geographic configuration, it becomes a matter of practical concern to define regions according to specific purposes or for making specific observations. For example, the Economic Council has defined regions after the established political boundaries. They have done this by referencing each province as a region or part of a region, and dividing Canada into 5 major regions comprised of the four Atlantic Provinces, Quebec, Ontario, the Prairie Provinces and British Columbia. These concepts of regions are useful here in identifying the broad geographic regions of disparity. On the other hand, regions have also been identified according to common characteristics at the sub-provincial level or small area level. This too is a useful concept and is employed here to identify and contrast those parts of different provinces with above average income as compared to those with sub-average incomes.

2.9 A standard approach to identifying regional economic disparities is by making comparisons of per capita differences in personal income and personal disposable income. There are certain qualifications associated with this approach. For example, income statistics reflect, but do not qualify the extent of, different price levels among regions or between urban and rural environments. For the most part income statistics do not take into account the value of home produced food at the rural level nor do they reflect the difference in quality of life between rural and urban standards or among different urban centres or among different regions. Income statistics for purposes of identifying regions of disparity also suffer from the fact that continuous

data are not available in annual time series at sub-provincial levels, although some annual data are now available from the Department of National Revenue. The last detailed survey on incomes at the sub-provincial level was carried out by the Dominion Bureau of Statistics in the 1961 census.

2.10 This weakness in the data is probably not as serious as it would at first appear. While substantial changes have occurred in the general levels of income over the last nine years, documented by statistics at the provincial level, there is little reason to believe that a substantial change has taken place in the income distribution according to geographic patterns. Despite its shortcomings and limitations, the personal disposable income measure still appears to be the best single means of identifying regions of economic disparity. Other measures can be derived from it. For example, by deducting personal transfer payments the earned income, or "income earning capacity" of a given region can be ascertained. For the most part, it is found that anomalies in income data can be explained in a logical manner. Furthermore, there are other indicators of regional disparities, such as levels of education and infant mortality rates that are correlated with the income data.(1)

2.11 A comparison of per capita incomes by provinces is shown in Attachment number 1. The income values are shown in current dollars and are given as averages over the 3-year periods 1926-28, 1946-48 and 1966-68. These periods reflect times of fairly normal economic conditions in Canada and the 3 year averages iron out any shortrun fluctuations.

---

(1) For example see Economic and Social Disadvantage in Canada, a series of maps by ARDA, Dept. of Forestry, Ottawa, 1964.

2.12 From Attachment 1 it can be seen that personal disposable incomes in the Maritime Provinces and Quebec have persistently remained below the national average. At the time of Newfoundland's entry into Confederation in 1949, and since, it has also been considerably below the national average. The Provinces of Manitoba and Saskatchewan have generally shown a somewhat erratic behaviour in regard to per capita personal disposable incomes, dipping below the national average during the 1967 period, whereas Ontario, British Columbia and Alberta have generally registered above average incomes.

2.13 Although Attachment 1 documents income disparities at the broad regional level, it is necessary to refer to income statistics at the sub-provincial level in order to show the relevant characteristics of regional disparities. Attachment 2 shows all those localities in Canada which in 1961 had a greater per capita disposable personal income than the national average.(1) In the way of contrast, Attachment 3 shows those localities which had very low per capita incomes in 1961, estimated at less than 70% of the national average.

2.14 One conclusion drawn from these tables is the definite relationship which exists between above average levels of income and the degree of urbanization. Centres such as Windsor, London, Hamilton, Toronto, Ottawa and Montreal all register above national average incomes.

---

(1) The localities or regions used here and the statistics that relate to them are taken from the work of P. Camu, E.P. Weeks, Z.W. Sametz, Economic Geography of Canada, Macmillan, Toronto, 1965. In their work, the authors describe 68 economic regions covering all parts of Canada. For the purpose of this report the names assigned to these regions by the authors have not been used, but rather the regions have been identified by the name of its principal trade centre.

This was also true of the urban centered localities of Winnipeg, Calgary, Edmonton, Vancouver and Victoria. Even urban centres which in 1961 registered per capita incomes below the national average showed incomes above those of their respective provinces. For example, from a detailed analysis of the data average per capita income of Halifax was 8% above the average for the Province of Nova Scotia; Saint John was 10% above that of New Brunswick; Regina and Saskatoon were 18% and 14% respectively above the Saskatchewan average.

2.15 It might also be noted that certain outlying centres such as Prince Rupert and Prince George in British Columbia registered per capita incomes above the national average levels. Although not shown in the attachments, this was also true of the Northwest Territories, the Yukon and the Mackenzie District. One explanation here would seem to lie in the remoteness of these particular regions and that high wages are a requirement to attract skilled labour in compensation for a factor of isolation.

Symptoms and Causes of Regional Disparity

2.16 There are many factors which affect economic development and in general they are interdependent. For this reason it is difficult to classify any particular factor as either a cause or a symptom of regional disparity. In practice, most factors are both. For example, variations of wage levels or disposable incomes among areas is an indicator of regional disparity. At the same time wage differentials can and do attract skilled labour thus serving to make the growing areas even more attractive for further economic activity, while making the depleted areas less attractive. There are, however, some broad general factors in

regional development that require further elaboration. These include resource endowment, population and markets, industrialization and, finally, public policies.

2.17 Resource Endowment and Industrial Base - The prosperity of any given region is a reflection of its resource endowment. For example, E.J. Hanson, in a case study of the oil industry in Alberta clearly demonstrates the impact that the discovery of oil has had upon the economic development of that province.(1) Reliance on a single resource however is not generally sufficient for sustained prosperity or growth of a region. This is exemplified by the ups and downs of the Prairie economy which has been tied to and is highly dependent upon grain markets. The falloff in the uranium market and the subsequent decline of Elliott Lake is another example of a local area tied too closely to a single resource. Combination of resources is important in certain instances of sustained regional development. These are taken to include not only renewable and depletable resources but also the attributes of certain physical features such as natural harbours or waterways and the environmental characteristics of climate. Some authorities designate climate as a major determinant or deterrent to the development of a region.(2)

2.18 The pattern that has developed in Canada with regard to resource development is one in which hinterland communities perform mainly resource extraction functions. Farming and fishing in the prairies and coastal provinces are historical and continuing examples of this relationship. The pulp and paper mill towns where the bulk of the product is

---

(1) Hanson, E.J., Dynamic Decade, McClelland, Toronto, 1958.
(2) Fuchs, R., Changes in Location of Manufacturing in the U.S. Since 1929, Yale University Press, 1962.

transported to the larger urban centres or exported for further processing are further examples of resource extraction in the hinterland areas. This is also true of the mining communities such as Flin Flon and Thompson in Manitoba, or Yellowknife in the Northwest Territories. Recent oil discoveries in Northern Canada may also give rise to new communities developing in that part of the nation. As a rule the outlying communities do not have substantially large populations, for example 10,000 in Flin Flon and 4,000 in Yellowknife. The remoteness of these communities from the more settled areas of the country create special problems not only in regard to the development of transportation routes but also in regard to communications. It is a problem discussed at greater length at a later stage in this report.

2.19 Location, Population and Markets - The population across Canada is distributed unevenly throughout the area of the country. Ninety-seven per cent of the Canadian population reside within 400 miles of the U.S.-Canada border. More important, in terms of its implications for regional development policy and communications policy, the distribution of Canada's population is concentrated into a number of still smaller areas.

2.20 Over 52% of Canada's population resides in what G.M. Davidson refers to as the Canadian Industrial Heartland.(1) He describes the Industrial Heartland as stretching from the southwestern limits of Windsor along the St. Lawrence Lowlands to the northeastern limits of Quebec City. From end to end, it is approximately 700 miles long and in most cases less than 100 miles wide. In area it represents less than 2.5% of the nation's total land mass.

---

(1) Davidson, G.M., Physical Location of Industry of Canada, Ottawa, 1966. (Unpublished manuscript)

2.21 With over one half of the population, this area has had considerable importance and influence on the development of the Canadian economy. It is an area of both high production and large markets, see Attachment 4. The area contains 72% of Canada's manufacturing labour force. It also contains a high proportion of the skilled and professional component of the country's labour force, along with a major proportion of the facilities for higher education. The Industrial Heartland accounts for 56% of Canada's aggregate personal disposable income. Translated into dollars, it means this area commanded over 14 billion dollars in terms of personal income for the purchasing of goods and services in 1961 and in 1967 as estimated 23 billion dollars.

2.22 While the Canadian Industrial Heartland has implications for industry and commerce it has even greater implications for public utilities and for the telecommunication industry in general. In elementary terms, the 23 billion dollars disposable income is a measure of the heartland's ability to pay for consumer goods and services including telecommunication services. To focus attention further on the telecommunication aspect, the area being small has a distinct advantage with regard to network installation costs on a per capita basis. In reality however, there are other areas in Canada of growing commercial and industrial importance. The prosperity of the Industrial Heartland itself is dependent, to a degree, upon the interchange of commerce and communications with these areas and other parts of the world. This in turn has raised questions of policies and objectives in regard to the proportionate costs of transportation and communications between various regions in Canada. In communications the problem is further complicated by the fact that some of the services

are of a highly localized nature, while others relate to interregional communication and have special requirements, pertaining to commerce, defence and national unity. The particular geographic dispersion of our population, its related markets, incomes and ability to pay for public type services, is in part a cause of such practices as rate scheduling, involving cross subsidization and "cream skimming".

2.23 Industrial and Commercial Growth - The dynamics of regional economic growth are closely tied to growth in the industrial and commercial sectors. Historically, the attraction of the Industrial Heartland for new industry and for further commercialization has been strong. The reason for this can be explained in part by looking at some of the factors that underlie the entrepreneur's decision making process in regard to plant location.

2.24 A number of studies have shown three factors to be of primary importance in the location of industry: markets, materials and external economies.(1) Labour supply sometimes is also ranked among the main influences. There would seem to be no doubt that the location of markets is, for most firms, of greatest importance. Other factors such as the availability of transportation, public utilities and community facilities are more likely to influence the location of an industry only at the local level.

2.25 It appears therefore that decision making regarding the location of a new manufacturing plant may be viewed as a three phase process:

1) the selection of a region which can best provide the primary requirements of the firm;

---

(1) Ruttan, V.W. and Wallace, L.T., "The Effectiveness of Location Incentives on Local Economic Development", Journal of Farm Economics, November 1962.

2) the selection of an area where the basic facilities of production will be available;

3) and finally the selection of a community for a local site which can provide the firm with the best combination of factors that are important to the operations.

2.26 The factors as they relate to the three stages of decision making are shown schematically in the following model.(1)

Location Decision Making

Region	Sub-Region	Site
(Markets	(Labour	(Labour
(Materials	(Transportation	(Transportation
(External Economies	(Utilities	(Utilities
(Special Require-ments	(Land Costs	(Land Costs
	(Taxes	(Taxes
	(Local Attitudes	(Local Attitudes
		(Community Facilities
		(Room for Expansion
		(Planning Regulations
		(Location Incentives
		(Existing Buildings

The location of primary manufacturing plants tends to be more strongly material oriented as to sub-region and specific site selection than the general model shown here. In influencing plant locations through location incentives it is the secondary manufacturing industries that are the prime targets. The nature of incentives to manufacturing development in effect in Canada broaden their impact into the regional and sub-regional as well as the site phase choice of location.

2.27 The extent of which telecommunications has been a factor in the location of industrial plants is not clear. The availability of inter-regional communication systems is perhaps a more important element

---

(1) Davidson, G.M., op.cit.

in the process than is generally recognized. Recently the attention of economists has been drawn to the concept and analysis of a "market network" in contrast to the more traditional concept of a "market place".(1) As the name implies, a market network is the larger of the two geographic areas in which sellers and buyers can exchange information on prices, complete deals and arrange for the flow of goods or services as specified. The concept has important meaning for regional development and regional development policy. With an efficient communications system it means that the isolation of particular regions from the "market place" commences to break down or disappear, and the isolated region, or area, can capitalize on higher-to less important factors in attracting industry and commerce. Associated with the change is the recognition by firms that information costs are an increasingly important element in the cost structure of their business, particularly if such information costs reduce other cost elements such as inventory holding costs.

---

(1) Studnicki-Gizbert, K.W., "The Nature of Market Networks" in a paper given at the Canadian Economist Association, Winnipeg, 1970.

PART III FEDERAL POLICY ON REGIONAL DEVELOPMENT

3.1 Federal Government policies have had an increasingly important bearing upon regional development especially within the more recent years.

3.2 In the decades following the establishment of Canadian Confederation in 1867, the emphasis of federal policy was on national economic development. The assumption underlying this policy was that the development of a national economy, held together by regional specialization and with east-west trade, would automatically result in all regions sharing fully in the nation's growth and prosperity. The depression of the 1930s showed that this assumption was no longer valid and it exposed the physical weaknesses of the poorer provinces.

3.3 After the Second World War the Canadian fiscal policy was amended on the proposition that it should make it possible for every province to provide for its people services of average Canadian standards without the necessity of imposing heavier than average tax burdens. In this connection a system of fiscal equalization was adopted. The program was designed to equalize provincial public services or provincial revenues through the Federal Government augmenting the revenues of the low income provinces with equalization payments. In a sense this step marked the first phase of a federal regional policy in Canada.

3.4 The recession of 1957-61 and the accompanying high levels of unemployment once again emphasized the existence of inter-regional disparities in terms of income levels and employment opportunities. It also generated an increasing awareness of the long term persistence of

regional imbalances and their serious economic, social and political implications. To meet the situation, a second phase of regional development policy evolved in which fiscal programs were introduced that were to meet specific kinds of problems and needs in particular parts of the country. For example, under the Agricultural Rehabilitation and Development Act (ARDA) comprehensive projects, such as the Fund for Rural Economic Development (FRED), were established to aid rural areas having low incomes and land utilization problems; the Atlantic Development Board assisted the development of infrastructure projects such as power plants, water systems, and trunk roads in the Atlantic Provinces. A third program, administered by the Area Development Agency made financial grants to manufacturing industries locating in designated areas that were selected on criteria of high rates of unemployment and low levels of non farm family income.

3.5 During the lifetime of these three programs more than 850 million dollars were spent or pledged on specific development projects. (1)

3.6 In April 1969 the federal government made regional development policy explicit by creating the Department of Regional Economic Expansion. The establishment of the new department marked the beginning

---

(1) The sum of $850 million includes future expenditures taken over by the Department of Regional Economic Expansion including the FRED plan for Prince Edward Island estimated at $125 million over the first 7 years.

The above sum does not include related assistance given out by the federal government, such as loans under the Atlantic Provinces Power Development Act, coal subventions or the Maritime Marshland Rehabilitation scheme.

Source: From material for the O.E.C.D. prepared by the Department of Regional Economic Expansion.

of the present phase of Canada's federal-regional policy. The objectives of the Department relate to economic expansion and social adjustment in areas, or regions, which are deemed to require special measures to improve opportunities for the productive employment of the people and for their access to those opportunities.

3.7 The Department was established under the authority of the Government Organization Act, 1969. It defines the duties, powers and functions of the Department. The Act gives broad powers to the Minister of the Department with regard to the designation of special areas throughout Canada, general agreements with provinces, and provisions for the Government of Canada to enter into agreements in special areas with respect to commercial undertakings, where it is essential to the development plan of such an area. These agreements may include the establishment, expansion or modernization of any commercial undertaking in the special area. The agreements may include the guarantee of loans, principal and interest; and the payment of grants. The special assistance is limited, as determined by the Minister, to an amount not greater than that required by the private party to enable it to carry out the proposed commercial undertaking.

3.8 Under the Government Organization Act 1969, broad powers are provided to the Department of Regional Economic Expansion in regard to furthering the economic development and social adjustment within the special areas, and it does not preclude the possibility of financial assistance to the telecommunications industries if warranted. Special

Area agreements have been signed with a number of provinces which provide for federal assistance relating to certain types of infrastructure including the construction of schools, roads, water systems, sewage systems, etc. The agreements have also included financial assistance in regard to manpower training programs and to some primary industries. There has been no assistance to the telecommunication carrier system under the Special area agreements to date.

3.9 The Regional Development Incentives Act, (RDIA) administered by the Department, is more restrictive that the Government Organization Act and relates to financial assistance provided to establishments undertaking manufacturing or processing operations, and which are located in designated regions. Establishments carrying out the manufacture of telecommunication equipment are eligible for assistance under RDIA, however the activities relating to telecommunication transmission is not eligible.

PART IV IMPLICATIONS OF REGIONAL DISPARITY AND PUBLIC POLICY FOR TELECOMMUNICATIONS

4.1 Every province has areas which can be considered as under-developed and which qualify as "designated regions" under the Regional Development Incentives Act. The map included as Attachment 5 clearly shows the distribution of designated areas in Canada; it is noteworthy that the entire area of the four Atlantic Provinces is included.

4.2 Drawing on some of the underlying factors of regional economic disparities, as outlined previously, this section of the report sets out to examine in greater detail their implications and relationships to telecommunications. For two reasons the subsequent material draws heavily upon the telecommunication experiences in New Brunswick. First, it is publicly acknowledged that New Brunswick is a region of slow economic growth and many of its characteristics with regard to its economic organization can be considered typical of other depressed areas throughout Canada. Second, telecommunication statistics on New Brunswick were readily available to the authors. Moreover there was a considerable amount of related economic information pertaining to the province stemming from ARDA and other federal assistance programs.

Markets and Telecommunications

4.3 It is clear that economically disadvantaged regions have distinct characteristics from those of the more "favoured" regions. It is of practical concern in Canada that the majority of disadvantaged areas and regions are remote from the largest, fastest growing, most affluent populations, with the best domestic markets for most products. It means they are generally remote from most of the secondary manufacturing

facilities of the country and from the educational and social amenities provided by a more prosperous local economy. It has practical significance for the social well being of individuals and for the commercial outlook of businessmen.

4.4 The businessman operating in a remote area must overcome the handicap of distance. The magnitude of this distance handicap must not be underestimated for it permeates all business activities. For example, the businessman operating in a remote area or region faces:

- high cost for shipment of finished products to the principal market areas.
- high cost for shipment of tools and supplies manufactured in the more favoured regions.
- high costs due to travelling to and from locations of markets or supplies.
- delays measured in days when materials or information are required from the manufacturing centres of the country (compared to delays measured in minutes for his counterpart located in, say, Toronto).
- lack of ready access to advice from a large pool of expertise.

4.5 Usually, underdeveloped regions have lower labour costs than the more advanced regions. However, the inclusion of all relevant cost factors often more than counterbalances the lower labour costs and points to a cost disadvantage in the underdeveloped regions as compared to the more dynamic regions such as the industrial heartland.

4.6 It follows logically that, if good communications are important to a business located in the industrial heartland of the country, they are vital to a business operating from a region of economic underdevelopment.

4.7 A survey of various telephone administrations in Canada indicates that telecommunications have not been identified as a limiting factor in economic development. No specific examples are fully documented in Canada where inadequate facilities have resulted in an economic loss to an area. However, industry and government administrators can cite examples from their own experience where adequate telecommunication services have influenced the development of certain communities. For example, company management of a fish processing plant at Marystown, Newfoundland, decided against expanding the existing plant primarily on the basis of their previous experiences involving inadequate transportation and communication services to that community. On the positive side, International Telephone and Telegraph Company (ITT) recently announced plans for a major chemical-pulp complex at Port Cartier on the Quebec North Shore. Over a ten year period the company anticipates spending $400 million on plant and equipment, with the prospects of creating 3,000 new jobs. The area is handicapped by generally an inadequate road network, and transportation is mainly by boat or by air. In 1969 Québec-Téléphone completed a 375 mile $5 million microwave system stretching from Sept-Isles to Blanc-Sablon and thereby providing direct communication services to nearly all of the communities along the route. While it should not be inferred that the availability of adequate

communication facilities had a prime bearing on the location or the decision by ITT to build the complex, it is noteworthy that the company will have direct access to the services and that the timber reserves acquired by ITT coincide with the route served by the microwave system.

4.8 While telecommunications may not have been either a prime cause or constraint to economic development they have been a very important catalyst for development and a vital part of the economic infrastructure. There are several indications of this:

(a) Regions of high economic development (which usually means high prevailing income levels) invariably make more use of telephone communications than do regions of low development. Long distance use is higher in Ontario than in the Maritimes; it is higher in many areas of the U.S.A. than it is in Ontario. See Attachment 6 for representative figures.

(b) Telephone development (expressed by telephones per 100 population) is higher in areas of high development than in areas of low development. See Attachment 7 pages 1 and 2 for a comparison of telephone densities.

(c) Business telephone users generate higher calling rates than do residential users and this implies that a high level of business development is accompanied by a relatively high level of telephone usage.

(d) Telecommunications is, in a sense, a substitute for presence. Its availability in an underdeveloped area allows the user to overcome some of the disadvantages of distance. As the "next best thing to being there" telecommunications can substitute for travel with an

associated saving in time, cost and personnel. As a substitute for the mails, telecommunications can act to save time and to speed up a decision making process. As a means of access to information, telecommunications can allow quick and frequent access, by managers and other users in a remote area, to the pools of information and talented advisors found in large population centres. Attachment 8 tends to verify the concept that users in "remote" areas tend to spend relatively more on long distance calling than do more centrally located users - either through more frequent use or through payment of higher service tariffs.

4.9 It may be concluded that the efficiency of business operation and hence economic development in total is enhanced in those regions of economic disadvantage if telecommunications services are readily available at reasonable cost.

Industrial Base

4.10 The regions of slow economic growth tend to be industrially oriented to the resource-based industries and to have low levels of development of the secondary manufacturing industries. In New Brunswick, for example, most companies are either resource based or service industries; secondary manufacturing is at an early stage of development.

4.11 The resource based industries such as lumber and mining, tend to be relatively simple in operation and involve extraction of products from nature for shipment to outside markets. This "straight line" type of operation is also reflected in a relatively low usage rate of communications.

4.12 Secondary manufacturing, on the other hand, usually involves the coordination of a relatively complex series of inputs and operations before producing a product for local and foreign markets. It follows that such industries make relatively more intensive use of communications. If, for example, secondary manufacturing industry in New Brunswick experienced a sharp increase in rate of growth it would follow that the communications network would have to grow similarly at a faster rate than that of the "normal experience" with resource based industrial growth in the past.

4.13 Attachment 9 shows a comparison of the new capital expended by the New Brunswick Telephone Company construction program to the total net new capital investment in the province. In recent years the relationship has been fairly constant at 4 to 5 per cent. From this one can predict that an upswing in capital investment in secondary industry would cause a corresponding and relative upswing in communications expenditures. Thus the current "regional growth" programs designed to force feed growth of secondary industry, if successful, have important implications for telecommunications for they may be expected to generate rates of telecommunications growth faster than those of the past. This aspect will be further discussed in Section 5.

Urban and Rural Populations

4.14 One of the most obvious characteristics of the population in underdeveloped areas is their low density level. In all of New Brunswick, for example, recent estimates indicate that there are only 620,000 persons while metropolitan Toronto alone has about 2.4 million inhabitants. This low population density tends to increase the

costs of providing services (including telecommunications service) as noted in the Economic Council of Canada Fourth Annual Review:

> "Compared to urban settlements where greater population density makes economies in providing facilities, roads, public transportation and recreational facilities, the diminishing population density in farming areas make for diseconomies which are likely to raise per capita costs if the quality of these services is to be maintained. Moreover, there is a continuing need for improvement of these services....."

4.15 In the Atlantic Provinces, as in the case of other regions of low income, there is a higher rural population than in the more affluent regions of Canada. About 46% of the population in the Atlantic area lives in non-urban areas; this compares to about 20% in Ontario and an average of 27% for the country as whole.

4.16 The unit cost of telecommunications distribution services is inversely proportional to population density. In Attachment 10 some typical cost curves are given in support of this statement; not only is the per circuit cost higher per unit of distance in rural areas, but also the distance between customers is much greater. The costs of telephone switching, on the other hand, are proportional to the total number of telephones located in a switching area and building and land costs tend to be higher in metropolitan areas. On balance, it would appear that total telephone costs are inversely proportional to population density and the experience in New Brunswick bears this out. It is also apparent in the broadcasting industry that the costs per user served are higher in sparsely populated areas than in densely populated areas. It follows

that, if equal telecommunications service is to be provided, the costs per capita will be higher in a region of dispersed population.

4.17 By virtue of being relatively dispersed a rural population may be more dependent upon telecommunications than a more concentrated urban population. Radio and television, for example, are able to effectively counteract the time loss for physical distribution of news to a dispersed population, while the telephone can overcome the distance which otherwise would have to be travelled for social and economic contact.

Extending Education

4.18 In many of the underdeveloped areas the average level of educational achievement is low. This is a reflection of a scarcity of good educational facilities and below average teacher qualifications. These inadequacies in turn affect the high cost of facilities and poor salaries in areas with low per capita incomes and tax revenues. In some of Canada's outlying areas formal education levels are extremely low. For example, in Census Division 9, of Newfoundland, where communities are small and isolated, the average level of education in 1961 approximated grade four, and considering only adults 30 years and over, the average was nearer to grade two.(1)

4.19 Telecommunications facilities offer some promise as a means of reducing the cost or improving the quality of education. The use of computer oriented teaching aids using terminals remote from the large data centres, holds a great deal of potential for increasing the effectiveness of education. Throughout the more heavily populated regions in Canada, recent technological developments tend to favor the provision

(1) Source: based on material from Dominion Bureau of Statistics, Census 1961.

of videotape facilities in schools rather than direct broadcast educational television (ETV), although the broadcast television medium still offers a good means of adult education. In regions such as Newfoundland, where there is a large proportion of scattered rural population, ETV service requirements are stronger than in urban areas with the large school buildings and the possibility of using the more "flexible" video tape instruction. For example, the Atlantic School Broadcasts are considered by the Newfoundland Government as an important element in its education program. It is reported, in that province, that certain ETV programs, especially on fishing industries, have tremendous adult appeal. So much so in fact that some of the ETV programs are now scheduled for Sunday afternoons. In areas along the Labrador coast it is reported that some of the residents are so anxious to receive visual news and entertainment that they have purchased T.V. sets just for the purpose of picking up the occasional freak reception.

4.20 Cable television systems offered to the public on rental basis will, probably follow the current trend of being built mainly in the larger and more prosperous centres. This medium, too, holds considerable promise as a means of extending the use of television as an educational tool. However, the initial capital costs of such systems is considerable and if cablevision is to be encouraged in small centres it may be necessary to undertake a utility type of system to allow price averaging over large geographic areas.

4.21 Radio and television facilities are also a medium for education in the commercial sense. That is, they serve to acquaint the

population with the features of the market place and with opportunities for employment; they contribute significantly to the development of a demand for goods and services. As "commercial educators" the availability of radio and television services is vital to the economic development of an area.

4.22 Education is fundamental to the development of a region. It is held that some "critical mass" of educated people exists below which progressive social and economic development is not possible. In this connection the modern communications system is, itself, technologically complex. Its operation depends upon the availability of skilled people possessing a relatively high level of education. Thus, by its very existence in an area of economic disparity a modern communications complex contributes significantly to the upgrading of the education and skills of the labour force and in turn forms an important component of the region's "critical mass" of educated people.

Productivity Gains in Telecommunications

4.23 During the 1950s and 1960s the telecommunications industry's need for capital increased tremendously. At the beginning of that period, capital accounted for a third or less of the resource inputs to the industry, the other resources being land and labour. At the present time capital accounts for well over half of the primary resource inputs.

4.24 It is significant that the industry has substituted capital for labour in a particular way. Part of this substitution has been a deliberate attempt to improve productivity (for example, a single lineman equipped with tools valued at roughly $50,000 now produces more

work output in a day than did a seven man line crew with $6,000 worth of tools in 1957). Much of the substitution, however, has been a byproduct of a modernization process through which new or improved services demanded by the public can be provided only by means of sophisticated equipment.

4.25 Professor R.E. Olley, in his studies of productivity for Bell Canada, has found an annual average rate of productivity gain of 6.1 per cent, 1960 to 1967. This is roughly three times the 2% cited by the Economic Council for the nation.(1) No similar statistics are available for other telecommunications companies but it is probable that their ratio of productivity improvement approaches that of Bell. Prof. Olley indicates this gain has been possible only through the good use of capital in rather massive amounts.

4.26 The problem of the substitution of capital for labour cannot be entirely evaluated in economic terms: social values must also be considered. Telephone Companies can cite examples of situations in which villages have deprived themselves of the benefit of wages paid to manual telephone operators by vociferously demanding that their telephones be converted to automatic dial operation. It seems that the social value of modern service is in these cases greater than the economic value of an assured source of income for some members of the community.

Public Utility Policy

4.27 The telecommunications industry is, for the

---

(1) Olley, R.E. "Productivity and Capital" paper presented at the 41st Annual Meeting of the Telephone Association of Canada, Saskatoon, June, 1970.

Productivity as used here, refers to the changes in capital and labour inputs relative to the net value of product as output.

most part, regulated as a public utility by either federal or provincial legislation. It is therefore natural that policies in this regard have an important bearing upon the performance, growth and investment of the industry, which in turn has important implications for regional development. Some of the more important policies aspects, either explicit or implicit, are dealt with in the following.

4.28 Service on Demand - A prevailing operating philosophy practised by telecommunication companies in Canada has been to seek profit and business growth by having quality service readily available on customer demand. Frequently this is referred to as "service on demand". However, for regulatory purposes, it has deeper implications. It is significant that in many cases the principle of service on demand has been made a charter obligation on telecommunication companies or alternatively it has been applied in practise by the various regulatory bodies(1). On the part of the regulatory bodies the obligation placed on the telecommunication companies to provide service on demand stems from the measure of protection granted to them in the market place through the assignment of franchise areas or by the provision of monopoly over specific services. In the absence of overt competition it is commonly held by regulatory bodies that telecommunication companies should provide at least the standard and quantity of service that might be expected to prevail in the absence of such protection.

---

(1) See Revised Statutes of New Brunswick, 1952, Chapter 226, Section 11, better known as the "Telephone Company Act. In brief, the Act states that the Lieutenant Governor in Council may require the Telephone Company to extend its lines so as to afford telephone connections to any person desiring such extension within a reasonable distance (what constitutes reasonable distance is left to the discretion of the Lieutenant Governor in Council, and in practice it has been interpreted by the Regulatory Commission to mean the provision of service on demand).

4.29 In practise, and as referred to in the context of this report, "service on demand" is used in a commercial or economic sense. It purports to service on "effective" demand; that is, in the extension of telecommunication services the costs to the user of the service are governed according to the given rate structure of the region as established by the given regulatory board. The supplier, in carrying out the obligation to provide service, must reckon with covering not only the additional marginal operating cost from the revenue of the extended service but also the recovery of the associated fixed costs within a reasonable span of time. This is in contrast to what, in this report, we term "right to service" in which it is assumed that the access to telecommunication services is a given fundamental right of every citizen regardless of costs.

4.30 The distinction between the two concepts is important in terms of telecommunications policy and regional development. The "right to service" concept implies the extension of services to people where their requirements are somewhat greater than their capabilities to pay for the services. To provide services to these people would seem to require justification mainly on the grounds of social criteria and on equity considerations would require subsidization from general tax revenues rather than extracting additional tolls from the users of the existing telecommunication facilities. Examples where services should be extended mainly on social grounds relate to the northern reaches of Canada where the capital cost of extending plant facilities outweigh anticipated revenues but where basic telecommunication services are

important, not only to the individuals involved but also the nation in total. Other examples might relate to the more populous regions of Canada where in the case of very low income families the extension of basic telephone services might be decided on the basis of welfare criteria. The efficient use of subsidies should be governed by the different situations encountered. In some cases it may be desirable to provide direct subsidies at the supplier level for the construction of plant and equipment. In other cases it may be more efficient to provide services within the given rate structure, but with subsidization occurring at the user level as a part of welfare requirement.

4.31 A different aspect of the importance of telecommunication facilities with respect to regional development relates to the ease and availability with which the services are provided to the users. Some contributors to this report contend that the reason telecommunications has not been an obvious limiting factor to economic development in Canada is the wide acceptance by telecommunication companies to provide service on demand. In the more populous regions in Canada the businessman is free to locate his operations almost anywhere with the knowledge that communications will be available to meet his needs, at a relatively short notice, and at reasonable costs. Further to this, it is noteworthy that in Canada queuing for telephone service has not been a problem. This is in contrast to the situation in some of the European countries where funds are allocated to communications on a budgetary system giving little priority to user demand and where the problem in regard to queuing for services is notable. It is beyond the scope of this report to draw

a comparative analysis between the regulatory systems used in Canada with those of other countries as to their implications in regard to regional development.(1) However, an analysis of this nature would require not only an investigation of the queuing problem but also how priorities in the telecommunication services are established and satisfied.

4.32 In Canada there is some evidence which suggests that users do attach considerable importance to telecommunication services. Attachment 11 lists telephone revenues as a percentage of personal disposable income for a relatively prosperous area of New Brunswick (Moncton) and for an area of considerable economic disadvantage (Gloucester County). Two factors should be noted. The first is that a significant portion of disposable income is allotted to telephone communications, 3.8 per cent in Moncton, and this reflects, presumably, its value to the user. The second is the remarkable rate of growth in communications expenditures in the Gloucester area during the 1960s - a period when ARDA and mining activity were injecting large amounts of income into the area. Both series tend to confirm that use of communications is given high priority as funds become available out of rising incomes. It also points to a close correlation, in this case, between the usage of telephone services in a given area with ability to pay. Furthermore, it leads one to draw inferences that service on demand is itself a function of the size and economic development of the given service area of a particular company.

---

(1) The legal considerations of regulatory experience in other countries are examined as a part of another telecommission study.

4.33 Cross-subsidization between services: An implied policy and one that cannot be disassociated with service on demand is that of encouraging cross-subsidization of local regulated exchange services by long distance and other high revenue non-regulated services. Provincial regulatory bodies have in general considered all sources of revenue in arriving at an allowable rate of return on total investments. This practise has tended to subsidize the low revenue producing exchange services. Moreover, a policy of applying exchange rates on a "value of service" basis tends to further subsidization from areas of high population density and high rates to areas of lower population densities, which have, by regulatory measures, lower rates. The procedure is in contrast to the "cost of service" principle according to which, as already mentioned, rural areas cost more per user to serve than do urban areas (see Attachment 10).

4.34 Modernization: The modernization of telecommunications facilities has not been restricted by any public policy for purposes of creating local employment. At first glance this might seem inappropriate for a region suffering from chronic unemployment. In the telephone industry in New Brunswick, for example, the conversion from manual to dial operation has terminated the employment of operators in small towns and villages. Nevertheless, there have been benefits. First, the change has brought a requirement for highly paid electrical and electronic technicians who help to form a base pool of skilled workers for the total area; second, the efficiency of the resulting modern telephone system is high and brings the benefit of fast, high quality communication to its users. Third, the purchase of large amounts of telephone sets and cable

have been instrumental in attracting to the province both a telephone set assembly plant and a cable manufacturer; these plants now export a significant portion of their output to areas outside New Brunswick and provide local employment in secondary manufacturing.

4.35 The Radio Act (The Revised Statutes of Canada) (1) In the past the various rules and regulations arising from the Radio Act have been administered on a fairly uniform basis across the country. In the allocation of specific frequency bands to certain services and in the technical requirements for equipment, rules have been devised for the correction of frequency congestion in certain areas of the country and to provide better coordination with anti-congestion measures taken in neighbouring, heavily populated centres of the United States. Unfortunately these measures have tended to be applied to the entire country; users in non-congested areas have often had to bear the cost of changing equipment or systems needlessly.

4.36 It has been the practice in the past few years for the radio licensing authorities to base their licensing considerations on only the technical parameters of the systems to be licensed. Until recently little regard was given to alternative means of providing service or to the purpose served by the radio system licensed. The end result has been the proliferation of lightly loaded private systems. While this in itself is not necessarily wrong, it has two after-effects which should be noted. First, it results in a compounding of the frequency

---

(1) See: Radio Act. Canada Gazette, Part II, Vol. 102, No. 14, July 24, 1968. The duties relating to telecommunications came under the Minister of Communications under the Government Organization Act, 1969. In brief, the Radio Act sets out the legislation which empowers the Minister to excercise regulatory authority over matters concerning the use of radio frequency spectrum and to the development and more efficient operation of radio communication facilities in the public interest.

congestion and coordination problems. Second, to the extent that circuits are set up on private systems rather than sharing the system of a common carrier, the common carrier is prevented from achieving economies of scale from which all users may benefit; these economies of scale will be dealt with in more detail below.

4.37 Competition and "cream skimming" - National policy has gone further than the mere permitting of private systems: it has encouraged the construction of duplicate common carrier systems to provide "competition" between carriers. This, it is understood, will be the subject of another Telecommission Study; however, regardless of the possible general merits of such competition, there are several potential effects arising from this policy which require attention in the review of telecommunications policy in the context of underdeveloped areas or regions.

4.38 There are significant economies of scale in inter-city telecommunication. Attachment 12 shows comparative costs for typical installed systems to illustrate the extent to which economies are possible.

4.39 Most of the regional telecommunications carriers are required by regulation to base their rates on a system of price averaging over the region that is serviced. To the extent that some internal heavy telecommunications routes produce net revenues in excess of allowable overall profit margins, it is possible to provide cross-subsidy to lighter routes where costs are relatively high.

4.40 If however, a second carrier enters to handle business in competition with the established carrier on the heavy routes but with no concomitant responsibility to serve "thin" areas within the region the

opportunity for cross-subsidy is lost. Such practice on the part of the second carrier is referred to as "cream skimming". In the long run it may result in higher prices for the users of the original carrier, and encourage further switching of system by the users. Ultimately, it may lead to a cost-based pricing system by the users in "thin" areas and the existence of duplicate, capital consuming telecommunications systems without the total possible economies of scale.

4.41 In Canada, there are two major national telecommunications carriers: the largest is the Telephone System and the other is the CN-CP System. The latter system operates as a telegraph system throughout Canada, and as a telephone system in the North West and Yukon Territories, as well as in much of insular Newfoundland. It carries a large proportion of private line services, with the Federal Government being a major user. Because of government purchasing policy the prices charged for these services are essentially equal and are similar across the country for all carriers.

4.42 In a disadvantaged area, the existence of duplicate carriers may be an economic disadvantage. For example; the New Brunswick Telephone Company has an extensive microwave network throughout New Brunswick. Construction of this system has been possible only because the concentration of defence private line services in the area has resulted in a sufficient level of circuit volumes; at any rate, all of the users of the system in New Brunswick benefit from low resulting circuit unit cost. On two of the heaviest routes (Quebec to Moncton and Moncton to Fredericton) competing microwave systems exist under CN-CP ownership. All of the traffic handled

by the two systems could have been handled by augmenting and extending one system, avoiding some duplication of capital investment on land, buildings, towers, power supplies, test and maintenance equipment, etc. Moreover, the fact that the available traffic is spread over two systems means that achievement of optimum economies of scale is pushed further into the future. To the extent that neither system might be able to generate enough revenue to provide an adequate return on investment, growth and development of the systems tend to be held back. A telephone company in this event may find itself under some pressure to try to recover a greater proportion of revenue from local service, since long distance and private line rates are set in a national context. The situation exemplifies a basic conflict between regional and national interests among the telecommunication carriers. On the one hand, regional carriers, and their regulatory boards, look toward long distance traffic as a means to offsetting lower local rates. On the other hand, it may be deemed in the national interests to encourage the duplication of certain systems, private or public, as an element of competition, strategic planning, or on the basis of social goals which might include national unity or be of national purpose. What seem to be appropriate measures for one region may not necessarily be appropriate for another region.

4.43 A similar situation no doubt exists in commercial broadcast television. Competition between networks or stations in a thinly populated area may have social appeal but is most uneconomical unless supported by high advertising revenues.

4.44 An example of this situation also exists in New Brunswick. In 1969 a Moncton television station, CKCW, was required by CRTC to establish a satellite transmitter in the Saint John area while a Saint John television station, CHSJ, was required to establish a satellite transmitter in the Moncton area. There is no doubt that viewers in the two areas now enjoy a wider selection of programming and a competitive advertising situation has been established. At the same time, the two stations have been faced with very significant capital expenditures and increases in operating expense. Since the total market area of the two stations remains the same, one must conclude that either the stations will adapt to lower profit levels or the advertisers will pay more. In short, the advantages of "forced" competition have their economic price.

PART V ADAPTATION OF FUTURE TELECOMMUNICATIONS SERVICES TO REGIONAL DEVELOPMENT PROGRAMS

5.1 The success or failure of regional development programs are foreseen to pose special problems of a financial nature to the telecommunications industries. For example, the industrial development incentives administered by the Department of Regional Economic Expansion may amount to 25 per cent of the approved capital costs of plant and equipment, and may range to a maximum of $12,000,000 for any one project. In addition, the majority of provincial governments now administer development programs designed to encourage industrial development within their respective provinces. The influence of these programs will cause variations in the degree of acceleration in rates of growth between regions and the significance of the environmental implications will vary in magnitude accordingly.(1) In total, if industrial development takes place on a significant scale it requires the expansion of a full range of basic and support services, essential to attract and maintain new industries and their associated population.

5.2 The telecommunications sector, being an important and valuable service to both the household and business sectors, must expand and develop to service this expanding market. The problems of adapting to accelerated growth, beyond the problems associated with providing greater service capacity, are to obtain the necessary lead time for

(1) For a case study on the changes in a local economy resulting from the introduction of industrial incentives and their resulting impact see: Yeates, M.H. and Lloyd, P.E. A Study of The Impact of the Area Development Agency Program in the Southern Georgian Bay Area, Ontario, Area Development Agency, Department of Industry, Ottawa, 1968.

planning and installing facilities along with the recruiting and developing of skilled manpower capabilities. In the case of regulated carriers, as in other capital intensive industries, the acquisition of capital at reasonable rates is important if they are to successfully adapt to accelerated rates of growth.

5.3 An example of planned acceleration through growth by the force feeding of special areas, is provided in the forecast for Saint John, New Brunswick. Saint John has a present employment of 36,000, a population of 101,000 and had an average annual compounded growth rate of 0.69% for the period 1961-1969 inclusive. Estimates in a report prepared for the Department of Regional Economic Expansion predict an increase in employment to 95,200, by 1987 and an increase in population to 236,000 based on 3.67% average annual compounded growth rate. (1)

5.4 This is a significant increase in growth and would tend to create some difficulty in adjusting, especially if the more rapid growth rate is more pronounced in the early years. If the growth is not evenly spread over the 17 year period, peaks and valleys will create additional adjustment problems. For example, employment in Saint John is forecast to grow by 13,000 during the first three years. The additional 13,000 jobs created can be translated into a population increase of 30,000 or 7,000 additional households. This represents an increase of 30% in three years. These households and the industries which attracted them will require expanded service facilities. The magnitude of the expansion of facilities will vary between different service sectors and together will have a highly significant impact upon the entire community.

---

(1) Source: Saint John Urban Region Impact Study Project E.O. 70700 May 8/70 Proctor Redfern, Bousfield & Bacon.

Capital Requirements

5.5 The extent of the capital required in telecommunications may be demonstrated by estimating the number of telephones required to meet the demands of the increases in population. Using the Saint John example, a population increase of 30,000 would approximate an additional 10,000 telephones. The current average construction expenditure is $1,470 per telephone. The gross capital requirement of the first three years would thus be in the order of $14.7 million.(1) All of these funds would have to be raised from external sources, as internal cash generation would be negligible during the first years and the program would be in addition to the "normal" construction program. The normal capital program for the entire province, 1970 to 1972, is estimated at $47.5 million of which $30 million must be financed externally. The corresponding normal capital program for the Saint John toll centre area is approximately $8.1 million. In short, capital expenditures for telecommunications for the Saint John area would be nearly double, with almost sole reliance on external capital.

5.6 A further indication of capital requirements is given in the ItalConsult report "Local Implications of the Proposed Complex" for Saint John. This report suggests that the capital investment required to provide electric and telephone services between 1971-1987 will amount to $75-135 million. On the basis of the last five years, (1965-1969) capital expenditures in telecommunications in the Saint John area have been approximately double that of the Saint John Civic Hydro. This is based on the capital costs of the Hydro distribution system of $2 million plus the

---

(1) Provincial average expenditures per net telephone station gained in the 1965-1969 period.

generation requirements involving approximately an additional \$.089 per kilowatt hour of generation or approximately \$6 million for the last five years. Comparable capital expenditures made by NBTel in the Saint John area amounted to \$14 million over the past five years.

Maintenance of High Quality Service

5.7 There is no reason to expect or even to suggest that the additional demand generated by accelerated growth should be met at a lower grade of service than that which is presently available. Growth pressure is no justification for lowering service objectives or standards and in fact the reverse would be desirable. If the industry is to be attracted and retained the quality of services available should be better, not worse, than average. This applies to all sectors offering services to the community and especially so to the telecommunications industry. Both the old and new customers expect, and have every right to expect, the best in telecommunications service.

Future Planning Requirements

5.8 In order that consistent top quality service may be supplied by the Telecommunications Industry, good planning is vital. The industry, like the electric power and the water utilities, is faced with high capital costs, long intervals between engineering, manufacture and installation of equipment, and equipment with relatively long periods between installation and economic "break even".

5.9 Like the power and water utilities, the telephone utility, faced with an expansion of the scale forecast for Saint John is placed under tremendous strain. Like the other utilities, it has the problems

of training and acquiring manpower, of obtaining capital and of engineering, obtaining and installing equipment on short notice. The characteristics of an overloaded telephone network, however, are different from those of a power or water supply network: rather than a gradual reduction of service available to its users, the overloaded telephone network has a rather sharp break point between fairly good service and advanced deterioration. This characteristic makes it essential to adequately plan for load peaks.

5.10 Given adequate lead time, the telecommunications industry can cope with normal economic growth. However, the introduction of regional development programs and the implementation of "planned" local growth bring out two elements of special sensitivity for investment in telecommunications. The two elements are: (a) the carrying costs associated with unused or under utilized capital, i.e., from time of construction to actual use, and (b) the risks associated with providing facilities where demand may or may not materialize.

5.11 Construction in advance on the basis of growth centre estimates would require a source of large amounts of "risk capital". The regulatory process for telecommunications companies makes this very difficult: For the most part, rates of return and tariffs are allowed on the basis of past, not future performance and experience. A rate of return sufficient to allow capital to be raised at the historical trend rate is quite likely to be insufficient to meet the needs of accelerated growth.

5.12 If, because of risks, capital is limited, accelerated development will lead to higher costs of telecommunications in the long run through the forcing of small uneconomic job sizes or through the installation of short lived types of plant in order to meet current service requirements only. For example, a shortage of capital could lead to construction of aerial cable plant (a short term solution) rather than allowing construction of underground conduit systems at the same time that streets and roads are built.

5.13 Rapid expansion due to regional economic development could also lead to forced patchwork services, with resulting increased long run costs and lower service standards. If high costs or low service standards for telecommunications services become characteristic of any area in need of economic development, this in itself would become a deterrent to an industry locating in that area and act negatively to the objectives of the Regional Development Program.

PART VI CONCLUSIONS AND SUGGESTIONS

Conclusions

6.1 In Canada there are many factors that give rise to regional disparities. These relate to variations in natural resource endowment, climate, location (central or not), size of markets and the degree of urbanization, industrialization and commercialization. The symptoms of slow growth regions show up in the form of below average per capita incomes, substandard levels of education and education facilities, inadequate health and welfare facilities and inadequate employment opportunities.

6.2 Governments at all levels have recognized the presence of regional economic disparities. In 1969 the federal Department of Regional Economic Expansion was created, and was given the objectives of furthering regional economic development and facilitating social adjustment.

6.3 Federal programs designed to assist slow growth regions are broad and include financial assistance relating to infra-structure, industry and manpower utilization. Although assistance to infrastructure has been an important element in regional development programs, there has been no direct assistance to the telecommunication service industries, to date.

6.4 Telecommunications are an integral part of economic infrastructure and are essentially vital for a region of slow economic growth, as their availability can compensate for some of the physical disadvantages of location in such a region.

6.5 The importance to society of telecommunications is growing both as an instrument of business and for the communication of non-commercial

information. In industry and commerce the importance of telecommunications is of growing importance as an item in the cost structure of firms and this trend will continue as firms strive to improve their productivity through the process of substituting the communication factor in place of other cost factors such as those relating to transportation or inventory holding costs. In the aggregate the substitution of factor costs in this manner can be expected to favour greater decentralization of industry and therefore benefit regional development.

6.6 The provision of service on demand has become a practice of Canadian telecommunications and is usually required by various regulatory authorities or has been assumed as a charter obligation by individual firms. Except in the case of a few communities which are comparatively isolated, there is little evidence that telecommunications has been a limiting factor in regional development. On the contrary, the evidence available suggests that telecommunications services has generally kept pace with other forms of development within the region examined in this study. In part, the situation is attributed to "service on demand".

6.7 The telecommunications industry is capital intensive and not unlike the power utilities in its need for construction of long lived plant.

6.8 Insufficient funds with regard to future plant expansion, elements of cross-subsidization among users resulting from differential costs of extending particular services, and practices by competitors which may give rise to "cream skimming" are issues that confront the telecommunications firms, generally, but they are more acute in regions where the economic base and market possibilities are sparse.

6.9 Regional development programs designed to "force feed" special areas will, if successful, result in an unusually rapid growth of population, industry and commerce. This will have two important implications for the telecommunication industries. 1. The extension of plant facilities phased with the early infra-structure requirements of the area will place additional financial strain on telecommunication firms. 2. In the event that anticipated development does not materialize, the risk element faced by telecommunication firms, under these circumstances, is increased.

6.10 It is important to distinguish between "service on demand" and the "right to service" where the latter implies long term subsidization of a particular service. On the basis of social criteria a measure of cross-subsidization may be considered acceptable, especially if it upgrades the average level of telecommunications services within the region. The practices should be recognized and their justification based on broader benefits to society.

6.11 The practice of cream skimming may give rise to a different type of cross subsidization, which might or might not involve interregional transfers of funds or the subsidization of telecommunication users in different regions. Competition between the telecommunication carriers may in some circumstances be economically undesirable in a region of slow growth even though broader compensatory benefits accrue to the nation as a whole.

SUGGESTIONS

6.12 To ensure continuing and adequate telecommunications services at both the National and Regional levels it is suggested that

a principal objective of telecommunications policy be one of providing service on demand.

6.13 It is suggested that the current policy of requiring economic justification as well as technical justification for issuance of radio licenses be continued, but include reference in the administration of licensing policy under the Act to take into account regional differences.

6.14 It is further suggested that the Department of Regional Economic Expansion in its policies on infrastructure give consideration to the provision of assistance to the telecommunication service industries where other programmes of that Department place undue stress on companies operating locally.

PER CAPITA PERSONAL DISPOSABLE INCOME, CANADA AND PROVINCES, 1927(1) - 1967(1)

	1927 Dollars	1947 Dollars	1967 Dollars	1927 Per cent of Canada	1947 Per cent of Canada	1967 Per cent of Canada
Ontario	504	898	2386	114.5	113.8	113.5
British Columbia	533	908	2283	121.1	115.1	108.6
Alberta	510	879	2124	115.9	111.4	101.0
CANADA	440	789	2103	100.0	100.0	100.0
Manitoba	452	828	2089	102.7	104.9	99.3
Saskatchewan	449	781	1929	102.0	99.0	91.7
Quebec	375	655	1926	85.2	83.0	91.6
Nova Scotia	299	648	1641	68.0	82.1	78.0
New Brunswick	274	578	1516	62.3	73.3	72.1
Prince Edward Island	241	457	1367	54.8	57.9	65.0
Newfoundland(2)	n/a	491	1214	n/a	62.2	57.7

(1) Centred 3-year average.
(2) 1950 instead of 1947.
Note: Ranked according to incomes in 1967.
SOURCE: Calculated from estimates from the Dominion Bureau of Statistics.

ATTACHMENT 2

LOCALITIES WITH PER CAPITA DISPOSABLE PERSONAL INCOME GREATER THAN THE CANADIAN NATIONAL AVERAGE; 1961

Canada and Locality	1961 Census Population	1961 Census Labour Force	1961 Census Manufacturing Employees	Average Annual Wages or Salaries of Male Wage Earners	Aggregate Disposable Personal Income	Per Capita Disposable Personal Income
	thousands of persons			$	$'000,000	$
Canada	18,238	6,478	1,405	3,679	25,616	1,400
Montreal, Que.	2,019	779	246	3,970	3,250	1,610
Ottawa, Ont.	783	290	42	3,970	1,179	1,510
Toronto, Ont.	2,088	884	270	4,300	3,845	1,840
Hamilton, Ont.	762	285	110	4,010	1,345	1,760
London, Ont.	405	157	34	3,550	615	1,520
Windsor, Ont.	450	161	48	3,830	732	1,630
Kitchener, Ont.	373	146	49	3,580	559	1,500
Sudbury, Ont.	506	167	27	3,950	820	1,620
Thunder Bay, Ont.	217	76	13	3,840	339	1,570
Winnipeg, Man.	476	194	39	3,910	746	1,570
Flin Flon, Man.	47	15	1	3,920	80	1,710
Jasper-Banff, Alta.	20	8	1	3,380	33	1,630
Calgary, Alta.	371	141	14	4,030	603	1,620
Edmonton, Alta.	456	173	19	3,920	716	1,570
Cranbrook, B.C.	34	12	2	3,710	66	1,930
Trail, B.C.	71	23	3	3,940	133	1,880
Kamloops, B.C.	66	22	4	3,460	107	1,610
Vancouver, B.C.	908	331	63	4,140	1,492	1,640
Victoria, B.C.	291	101	16	4,040	479	1,650
Prince Rupert-Kitimat, B.C.	60	22	8	4,400	110	1,850
Prince George, B.C.	74	25	7	3,400	119	1,600
Dawson Creek, B.C.	31	10	1	3,880	47	1,510

Source: Based on economic regions and data from P. Camu, E.P. Weeks, Z.W. Sametz, Economic Geography of Canada, Macmillan, Toronto, 1965.

LOCALITIES WITH PER CAPITA DISPOSABLE PERSONAL INCOME LESS THAN 70 PER CENT OF THE CANADIAN NATIONAL AVERAGE, 1961

Canada and Economic Regions (identified by principle major centres)	1961 Census Population	1961 Census Labour Force	1961 Census Manufacturing Employees	Average Annual Wages or Salaries of Male Wage Earners	Aggregate Disposable Personal Income	Per Capita Disposable Personal Income
	thousands of persons			$	$ '000,000	$
Canada	18,238	6,478	1,405	3,679	25,616	1,400
St. John's, Nfld.	277	69	7	2,680	217	780
Grand Falls, Nfld.	83	19	2	2,890	72	870
Charlottetown (all PEI)	105	34	3	2,360	97	930
New Glasgow, N.S.	144	43	7	2,500	137	950
Edmundston-Woodstock, N.B.	158	48	5	2,790	151	960
Newcastle-Campbellton, N.B.	157	39	8	2,370	133	850
Rivière du Loup, Que.	401	106	12	2,140	256	640
Brandon, Man.	67	21	1	2,720	64	950
Dauphin, Man.	58	19	1	2,450	54	930
Yorkton, Sask.	129	46	1	2,740	115	890
Prince Albert, Sask.	212	71	2	2,670	185	870

Source: Based on economic regions and data from P. Camu, E.P. Weeks, Z.W. Sametz, Economic Geography of Canada, Macmillan, Toronto, 1965.

ATTACHMENT 4

COMPARATIVE STATISTICS: CANADA AND THE "INDUSTRIAL HEARTLAND" 1961

Regions	1961 Census Population	1961 Census Labour Force	1961 Census Manufacturing Employees	Average Annual Wages or Salaries of Male Wage Earners	Aggregate Disposable Personal Income	Per Capita Disposable Personal Income
	thousands of persons			$	$ '000,000	$
Canada	18,238	6,472	1,405	3,679	25,616	1,400
"Industrial Heartland"						
Quebec Metro	644	212	37	3,160	653	1,010
Sherbrook-Granby	462	145	44	2,690	462	1,000
Trois Rivieres	301	93	29	3,100	306	1,020
Joliette-Farnham	738	233	66	3,110	794	1,080
Montreal Metro	2,019	779	246	3,970	3,250	1,610
Hull	182	58	11	3,220	166	1,160
Ottawa-Kingston	783	290	42	3,970	1,179	1,510
Peterborough	335	115	30	3,510	352	1,330
Toronto Metro	2,088	884	270	4,300	3,845	1,840
Hamilton	762	285	110	4,010	1,345	1,760
London	405	157	34	3,550	615	1,520
Kitchener	373	146	49	3,580	559	1,500
Windsor	450	161	48	3,830	732	1,630
Total: Industrial Heartland	9,542	3,558	1,016		14,258	
Industrial Heartland as Per Cent of Canada	52.3	55.0	72.3		55.7	

Source: Based on economic regions and data from P. Camu, E.P. Weeks, Z.W. Sametz, Economic Geography of Canada, Macmillan, Toronto, 1965.

DESIGNATED REGIONS

under Regional Development Incentives Act

RÉGIONS DÉSIGNÉES

aux termes de la Loi sur les Subventions au Développement régional

August 1969 Août 1969

I. Total Telephone Calls Per Person, Selected Countries, 1967

Canada	668
United States	667
Sweden	599
United Kingdom	145
West Germany	124
Brazil	106
Portugal	73
India	3

Source: The World's Telephones 1968

II. Long Distance Calls Per Person, U.S.A., Canada and Provinces, 1966

U.S.A.	26
Canada	16
Ontario & Quebec	19 (approx)
Alberta	18
Saskatchewan	16
P.E.I.	16
Nova Scotia	15
Manitoba	12
New Brunswick	12
Newfoundland	7

Source: Misc. Statistics NBTel (Unpublished)

Selected Statistics of Telephone Development

Area	Telephones per 100 Population 1968
World	6.4
North America	50.6
Europe	11.2
South America	2.6
Asia	1.2
U.S.A.	51.8
Sweden	49.8
Canada	40.6
United Kingdom	21.8
Germany (West)	17.2
Portugal	6.5
Brazil	1.7
India	0.2

Source: The World's Telephones - 1968
- American Telephone & Telegraph Company

Area	Telephones per 100 Population	
San Francisco, California	82.9	Highly economically developed areas of U.S.A.
Palo Alto, California	75.0	
Los Angeles, California	63.1	
Seattle, Washington	66.0	
Boston, Massachusetts	66.0	
Louisville, Kentucky	49.9	Cities subject to "U.S.A. Disparity"
Covington, Kentucky	43.4	
Meridian, Miss.	42.6	
Tuscaloosa, Alabama	36.0	
Toronto	62.6	Relatively highly developed economies
Vancouver	56.4	
Calgary	55.4	
Oshawa	43.4	
Saint John, N.B.	44.3	Areas of low economic development
St. John's, Nfld.	35.8	
Trois Rivieres	35.8	

Source: The World's Telephones - 1968
- American Telephone & Telegraph Company

I Business Toll Message Revenues per Business Main Telephone

Highest State in U.S.A.	(1966)	$ 316.2
Bell System U.S.A.	(1966)	$ 289.4
New Brunswick	(1967)	$ 269.6
Ontario & Quebec	(1967)	$ 257.2

II Residence Toll Message Revenues per Main Telephone

Highest State in U.S.A.	(1966)	$ 67.7
Bell System U.S.A.	(1966)	$ 51.1
New Brunswick	(1967)	$ 38.8
Ontario & Quebec	(1967)	$ 31.5

Source: Prepared by NBTel.
All figures are approximate but
believed to be essentially correct.

TELEPHONE CONSTRUCTION PROGRAM AS A % OF NEW CAPITAL SPENDING IN NEW BRUNSWICK

	%
1958	4.1
1959	2.9
1960	3.8
1961	5.0
1962	5.9
1963	5.6
1964	4.3
1965	4.2
1966	4.2
1967	4.8
1968	4.4
1969 (est.)	4.3

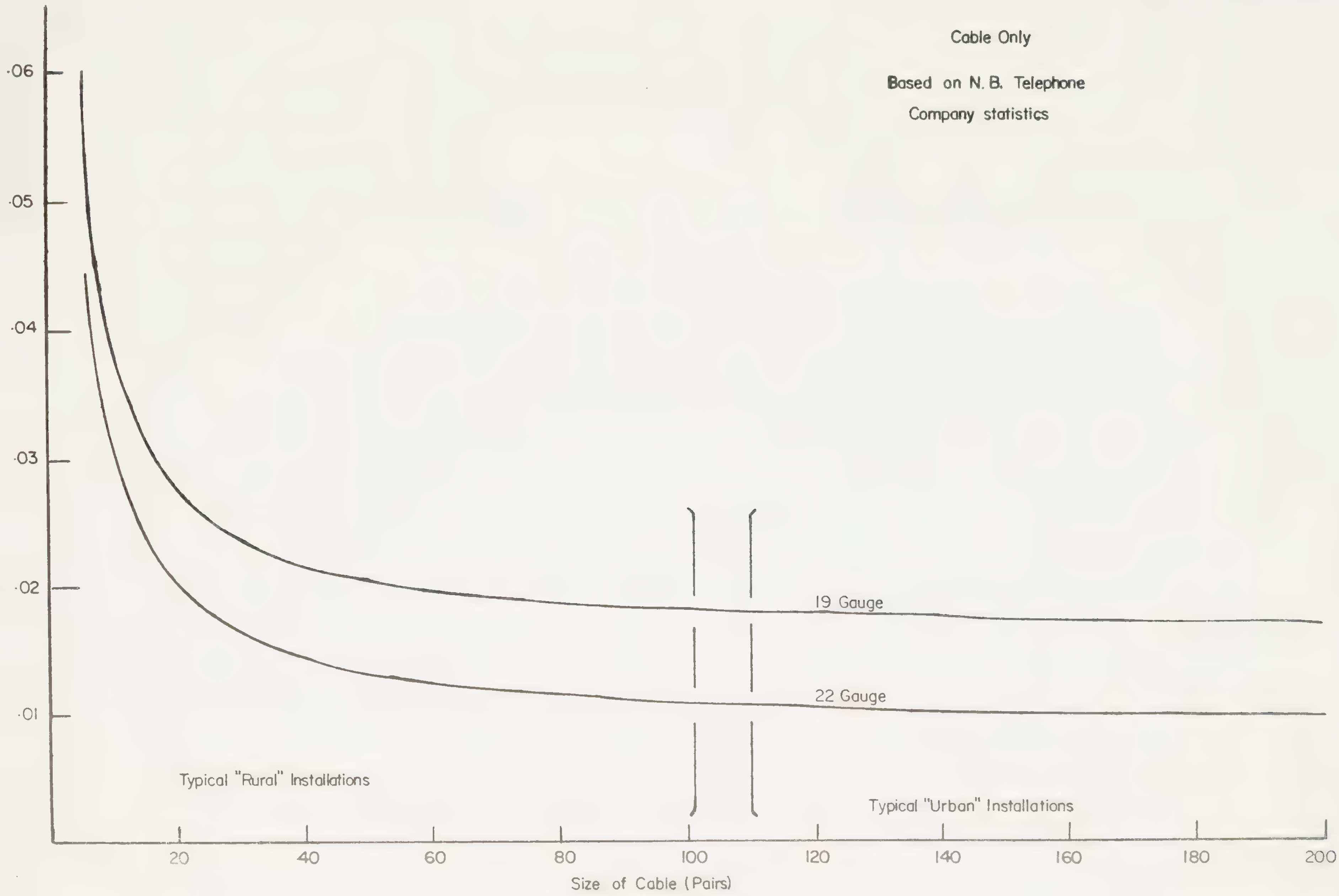
Source: NBTel

AVERAGE TOTAL INSTALLED COST PER CIRCUIT MILE

100 Pair Cable (more or less typical of rural distribution size and construction)		
	Aerial	$85.
	Buried	83
400 Pair Cable (such atypical of "semi-metro" distribution sizes)		68.
If placed in underground conduit		75

Source: Based on N.B. Telephone Company costs.

Theoretical Relative Cost Per Pair-Ft. of Buried Cable
(Regression Line Y= A+B/X)



ATTACHMENT 11

LOCAL AND TOLL REVENUES PER TOTAL PERSONAL DISPOSABLE INCOME, MONCTON AND GLOUCESTER

Location	Year	Local %	Toll %	Local & Toll %
Moncton	1960	2.0	1.3	3.3
	1961	2.0	1.3	3.3
	1962	2.0	1.3	3.3
	1963	2.2	1.5	3.7
	1964	2.3	1.5	3.8
	1965	2.5	1.8	4.3
	1966	2.2	1.6	3.8
	1967	2.2	1.6	3.8
	1968	2.1	1.7	3.8
Gloucester	1960	0.5	0.4	0.9
	1961	0.6	0.5	1.1
	1962	0.6	0.5	1.1
	1963	0.6	0.6	1.2
	1964	0.8	0.6	1.4
	1965	0.8	0.6	1.4
	1966	0.8	0.6	1.4
	1967	0.8	0.7	1.5
	1968	0.8	0.7	1.5

Source: NBTel

TYPICAL RELATIVE CAPITAL COSTS PER 4 KC/S CHANNEL

A. Microwave

	Relative Capital Cost Per Circuit Mi.
Heavy Route (1800 Channels)	1.0
Heavy Route (960 Channels) System "A"	1.04
" " " " System "B"	1.34
Medium Route (600 Channels)	1.70
" " (300 Channels) System "A"	2.83
" " " " System "B"	3.13
Light Route (60 Channels)	14.83

Above figures are based on N.B. Telephone Company records of installed costs including buildings, towers, protection switching and radio equipment and would vary for either administrations depending upon purchasing practices and geography.

B. Cable Carriers

System "A" 24 Channels, AM Modulation	74.07
" "B" 24 Channels, PCM "	98.07
" "C" 24 Channels, PCM "	64.73
" "D" 12 Channels, AM "	58.27

Above figures based on N.B. Telephone records and exclude costs for the bearing cable facility.

C. Channelizing Equipment

No. of Channels	Relative Cost Per Channel End
60	1.96
120	1.40
300	1.12
600	1.03
960	1.0
1800	1.0

(Note: These figures are per end and not comparable to per mile figures under "A" or "B" above.

Source: Prepared by NBTel.

TELECOMMISSION

Study 2(e)

Telecommunications Carriers Market Projection and Analysis

The Department of Communications

TELECOMMISSION

STUDY 2 (e)

TELECOMMUNICATION CARRIERS
MARKET PROJECTION AND ANALYSIS

SUBMITTED BY

TRANS-CANADA TELEPHONE SYSTEM

CANADIAN NATIONAL-CANADIAN PACIFIC TELECOMMUNICATIONS

MARCH 1970

Available by mail from Information Canada, Ottawa,
and at the following Information Canada bookshops:

HALIFAX
1735 Barrington Street

MONTREAL
1182 St. Catherine Street West

OTTAWA
171 Slater Street

TORONTO
221 Yonge Street

WINNIPEG
393 Portage Avenue

VANCOUVER
657 Granville Street

or through your bookseller

Price 50 cents Catalogue No. Co41-1/2E

Price subject to change without notice

Information Canada
Ottawa, 1971

TELECOMMUNICATION CARRIERS MARKET PROJECTIONS AND ANALYSIS

Telecommission - Section 2(e)

CONTENTS

CONTENTS

LIST OF TABLES

TELECOMMUNICATION CARRIERS MARKET PROJECTION AND ANALYSIS

TELECOMMISSION - SECTION 2(e)

RESUMÉ

The telecommunications industry, as used in this report, includes the members of the Trans-Canada Telephone System, CN-CP Telecommunications, COTC and other operating telephone, cable and telegraph service companies (Reference - DBS catalogues 56-201 and 56-203).

Growth of Telephones

The age distribution of the existing Canadian population will result in a high level of growth of the labour force, new households, and family formations, during the 1970's. This will produce relatively high absolute demand for residence main telephone service, the largest single category of telecommunication services. Growth of residence main telephones is estimated at approximately 2.6 million during the 70's as compared to 1.9 million during the 60's. The rate of growth, on the enlarging base, will continue to decline during the 1970's and will fall off more sharply after about 1980 because of the reduced proportion of people entering the labour force age group.

Demand for all Telecommunications Services

The impacts of large increases in the labour force, housing demand, construction, and family formation will stimulate many sections of the economy, contributing to direct and indirect demand for telecommunication services - both business and residence - and both local and inter-city. Throughout the entire period to 1990 there will be increasing requirements for services which provide visual and data capability as well as voice.

Trend Towards Urbanization

The continued trend to urbanization will contribute to much more rapid growth in the larger centers than in smaller ones. There will be little change in the size of the non-urban population, but there will be definite changes in their telecom needs. The increase in the size and number of major metropolitan complexes will require further evolution of existing extended area service plans with customer needs, costs, customer acceptance and willingness to pay, and capital availability as the relevant considerations.

New Service Needs

Social and technological change and new needs evolving from the "Information Explosion" and the "Post - Industrial Society" are resulting in re-examination and evaluation of their roles by governments, business, and other institutions. From this search pattern, during the next few years new telecom needs and uses will be identified. Particularly relevant, from the viewpoints of national economic productivity and of telecommunication carriers' roles are customers' information processing, storage and retrieval requirements to accommodate the aural , visual, and graphic telecommunications needed for the third and fourth generation management systems of the 1970's and 1980's.

In view of these emerging trends and needs it is expected that the future rate of growth for the telecommunication industry may well exceed the rate which has been experienced during the past fifteen years. This growth has been reflected in the revenue projections for the short and long term shown in Tables 7 and 8 of this report.

Future Capabilities of the Telecom Industry

The industry is confident of its ability to meet the nation's requirements in the years ahead, as it has in the past. Organizational structures and procedures and personnel concepts will continue to be adapted to the requirements of growth and change. New methods from application of the behavioural sciences, management sciences, and new technical aids to management control will continue to be developed and introduced. An important consideration is that the growth and apparent future prospects of the industry must remain good in order to attract and retain the numbers of capable people needed on a continuing basis.

In the current period of rapid social and technical change, a fundamental requirement will exist for extensive technical research and development programs backed by greater emphasis on market, motivational and social research programs than have been necessary in the past.

Also fundamental for the future will be the industry's ability to attract on reasonable terms and on a continuing basis the large amounts of new capital needed to meet Canadians' demands and expectations for new and existing services. The industry is fully aware of its national

obligations implicit in its public utility role. This is a matter in which regulatory processes are intimately involved. The needs of the future can best be met in a regulatory climate which encourages both innovation and a constant belief on the part of the industry in the importance of their contribution to the continuing development of the country. This suggests that a basic element in regulation should be consideration of national objectives and of what users will be expecting the industry to accomplish as well as the current levels of rates and earnings. This is particularly appropriate at this time in preparing for the increasing social complexity and the resulting challenges, opportunities, user needs, and problems inherent in the national implications of the "information explosion". As user needs are identified and value attitudes emerge from the consensus forming process, it will be important that the telecommunications industry be capable of moving quickly with the resource components to meet the needs.

TELECOMMUNICATION CARRIERS MARKET POTENTIAL AND ANALYSIS

TELECOMMISSION - Section 2(c)

PART 1 - GENERAL

A Definitions

The term telecommunications industry as used in this report includes the members of the Trans-Canada Telephone System, Canadian National - Canadian Pacific Telecommunications and other operating telephone, cable and telegraph service companies. ([illegible] DBS catalogues 56-201 and 56-203). It excludes the cable television and radio and television broadcasting industry, although [illegible] services by the telecommunication carriers.

"MARKET POTENTIAL" represents the total sales volume available if all customer needs are met.

The term "FORECASTS" represents that portion of the market potential which might reasonably be obtained by the organizations providing the various services.

The word "TELECOM(s)" is used as a shortened form of "Telecommunications".

TCTS has been used as an abbreviation for the Trans-Canada Telephone System.

B Basic Assumptions and Sources of Data

- Data on telephone growth has been based principally on the [illegible] of TCTS members and on DBS data.

- It is assumed that the numbers of telephones per 100 population will continue to increase in future as in the past reflecting social and economic needs.

- Rate adjustments both upward and downward [illegible]. The long term effects of inflation will require upward rate adjustments despite the introduction of new cost reduction techniques and methods. The industry over the years expects to be able to offer [illegible] value and service in real dollar terms.

- The assumptions on population growth and the population estimates agree very closely with the most recent views of the Economic Council of Canada. Both population and household growth include the effect of the medium level of net immigration assumed by the Economic Council. The household growth estimates will be affected by the prevailing age distribution of the current Canadian population, which will result in a continuing high though declining rate of family formations.

PART II - POPULATION FACTORS AND TELECOMMUNICATION GROWTH

A Population and Household Forecasts:

Table 1

Estimated Canadian Population (in millions)

1975	23.5
1980	25.5
1990	30.0

Source: Estimates based on Economic Council data.

Notes:

1. Compared with the other major OECD* countries, Canada has a much smaller proportion of its population in its labour force: 37% compared to 40 to 48% in other countries. ** At present the Canadian population has an unique age distribution. Approximately 50% of the total population is younger than 25 years.

   * Organization for Economic Co-operation and Development
   ** Reference the Economic Council of Canada's Fourth Annual Review - 1967

2. The Canadian labour force has been growing very rapidly. This results mainly from the post-war baby boom and, to a lesser extent, from immigration and increasing female entry into the labour market; rapid absolute growth, though at a declining rate of growth, will take place during the next decade.

3. As the age distribution changes and the labour force increases, major effects on spending, consumption, and investment will occur. The demand for housing and services (including telecommunications) will increase with the rise in family formations.

Table 2

Canadian Households Growth

	Total Households (in millions)	Increase in Households Number (in millions)	Increase in Households Average Annual Rate of Growth
1950	3.4		
1960	4.5	1.1	2.8%
1970	5.8 (Est)	1.3	2.6%
1980	7.3 (Est)	1.5	2.3%
1990	9.0 (Est)	1.7	2.1%

Source: Estimates based on Economic Council data.

Notes:

1. Net family formation is, of course, the largest component of total household growth.

2. The principal significance of these trends for the telecom industry is that new households involve large spending commitments for goods and services extending over many years, contributing to direct and indirect demand for telecom services - both business and residence. These effects have been very apparent during the 1960's and will continue during much of the next decade.

3. The table indicates a significant decline in the rate of household growth (from 2.8% in the decade of the 60's to 2.1% in the 80's).

Table 3

Canadian Population Age 20 and Over (in millions)

	Population	Increase in Population: Number	Increase in Population: Average Annual Rate of Growth
1970	13.0		
		[illegible]	[illegible]
1975	14.9		
		2.1	2.7%
1980	17.0		
		2.0	2.3%
1985	19.0		
		1.7	1.8%
1990	20.7		

Source: Estimates based on DBS and Economic Council data.

Notes:

1. The current age distribution of the Canadian population will result in a decline in the rate of growth of the working age population, and this is most significant to the telecom industry. Accompanying this sharp decline in the rate of growth there will also be a decline in the absolute numbers of people being added after about 1980 to this population group. This existing trend will persist beyond 1990 because of the trend to smaller families and the smaller portion of the total population then under age 20.

B Telephone Growth Forecasts

Table 4

Residence Main Telephones (in millions)

	In Service	Increase Number	Increase Average Annual Rate of Growth
1950	1.9		
		1.7	6.6%
1960	3.6		
		1.9	4.3%
1970	5.5 (Est)		
		2.6	3.9%
1980	8.1 (Est)		
		2.8	3.1%
1990	10.9 (Est)		

Source: TCTS estimates.

Notes:

1. In terms of numbers, residence main telephone service represents the largest single category of telecommunication services. By the end of 1968, Canadian telephone development had reached 25 residence main telephones per 100 population. This represents 94 residence main telephones per 100 households. Even though the high level of main telephone development, combined with the expected decline in the rate of growth of households (Table 2), implies some slowing down in the future rate of main telephone growth, the absolute growth will continue to increase.

2. The decline in the percentage rate of growth will become more pronounced after 1980 as a direct consequence of the population age distribution. A similar impact on basic business services can be expected because of the lower rate of labour force additions, family formation, and housing demand.

3. The data in this table on residence telephone development is merely illustrative of trends which will have somewhat similar effects on other sectors of the telecommunications industry. Concurrently with the declining growth rates of these traditional segments (from 6.6% in the decade of the 50's to 3.1% in the 80's), new social, economic, and technical developments are creating challenges for the industry in the form of needs for new and more complex services. The new demands, resulting from the so-called "information explosion" will require major commitments of capital, research and development effort and must be satisfied at the same time that the demand for conventional telecom services will continue to increase.

Table 5

Total Telephones
(in millions)

		1960	1965	1970 (Est)	1975 (Est)
Main Telephones	- Residence	3.6	4.5	5.5	6.75
	- Business	.6	.7	.8	.95
	- Total	4.2	5.2	6.3	7.7
Total Telephones	- Residence	4.0	5.3	6.7	8.7
	- Business	1.7	2.1	3.0	3.7
	- Total	5.7	7.4	9.7	12.4

Source: TCTS estimates

C Telecommunication Message Forecasts:

Table 6

Telecom Messages
Messages
(in millions)

	1960	1965	1970 (Est)	1975 (Est)
Local Switched Network Messages	9,365	12,138	15,500	19,500
Toll Network Messages	215	302	470	700
Telegram, Cablegram & Overseas Telex	18	16	13	

Sources: Estimates based on DBS historical data (Cat. No. [illegible] and 56-203)

Notes:

1. The message components are local and long distance voice, data and printed messages, telegrams, Trans-Atlantic Telex and cablegrams. The great majority of voice, data, and printed message traffic is carried on common facilities and the mix is continually changing over time. Because of these two conditions, it has not been feasible to the present time to obtain a sound statistical base for each category. Consequently they are presented in this table on a combined basis.

2. Messages over private lines and continental Telex have been excluded because the usage is private to the user and is not measured by the carrier except on the user's request.

3. The historical decline in telegram messages is offset partially by the growth of cablegram and overseas telex messages.

PART III - SHORTER TERM (TO ABOUT 1975) MARKET PROJECTION AND ANALYSIS

A Revenue Forecasts:

Table 7

Canadian Telecom Industry Revenues
(in millions - current $ of years shown)

		1960	1965	1968	1970 (est)	1975 (est)
A. TCTS and other companies (DBS Catalogue 56-203) -						
Local and misc revenues	(1)	410	585	760	930	[illegible]
Message toll revenues	(2)	197	310	430	500	[illegible]
Other toll revenues	(3)	21	53	78	110	[illegible]
B. CN-CP Telecoms, COTC and others (DBS Catalogue 56-201) -						
Combined revenues		59	86	117	140	[illegible]
C. Industry Totals		687	1,034	1,385	1,680	[illegible]

Source: Telecom industry and DBS historical data.

Notes:

(1) Main components - exchange telephone services, directory advertising, income from investments, local private line (telephone, data, teletype, radio and television) and service changes.

(2) Main components - inter exchange switched network long distance and TWX message charges.

(3) Main components - wide area toll services (WATS), inter-exchange private lines (voice, data, radio, television and miscellaneous), message switching data service and telpak.

(4) Additional revenues accruing to Telesat have not been estimated.

B Evolving Telecom Requirements to About 1975

No dramatic changes in needs and services, from the customer's viewpoint, are foreseen within this period. There will, however, be developments which will pave the way for significant change later. Precise timing is somewhat indeterminate, since it depends on the timing of customer needs, the result of innovation and in some cases on successful R&D.

The impact of these developments on the needs of individuals, commerce and industry, government, and education are outlined separately:

1. Requirements of Individuals

- The telecom requirements of individuals are considered mainly from the viewpoint of the residential householder.

- Service in the home of 1975 will present little fundamental change in appearance from now. The need for convenience of telecommunications in the home will gradually lead to more extension telephones. The percent of residence extension to main telephones, now about 20%, is likely to be at least 25% by 1975. This will be far short of the 50% development level already reached in the USA, presumably reflecting differences in the economies of the two countries and in value attitudes.

- A growing number of homes with requirements for high information flows will need additional main telephone lines. By 1975 the development still will be relatively small amounting to less than 1% of total households.

- The changing requirements of people in rural areas will reflect the changing nature of the non-urban economy. They are now demanding urban types of services.

- More people will require services in mobile, temporary, and part time homes as population mobility increases and for various other reasons. This can produce requirements for substantial amounts of service very quickly in unexpected locations. The location life of such services tends to be much shorter than average.

- Needs and wants of people for visual telecommunications in the home will increase. To 1975, almost all of the visual telecommunications in use will be the home television set. Many will be in colour and will be connected to cable television systems. Picturephone will have been introduced but for economic reasons will be used by few homes during this period.

- Touch-Tone is expected to be in use on more than a million residence telephones. Initially Touch-Tone is meeting the need for improved ease of calling. It has added utilities which individuals are expected to require such as the capability of end-to-end signalling for information transmittal and retrieval.

- Needs will exist for telecom access to stored audio information. Existing services of this type such as weather and time announcements, and language laboratories will be required and will be extended, mainly in the field of education. The more advanced educational organizations will be moving to meet these needs, for both regular students and adult continuing education, accessed through the home telephone.

- The requirements of individuals for data services may be considered under two categories:

  - the householder as a paying customer for data services -

    In this category, some limited needs will develop by 1975 but not to the point that computer based services for sale to residential individuals will have been developed to any significant extent.

  - The householder as a user of data services provided by various organizations to improve their operations for use by members of the public without charge.

    In this category, more but limited progress will have been made by 1975. Examples are audio retrieval and other such information systems, using Touch-Tone input over the home telecom line with voice answerback. Such a system might be used in the field of telephone ordering of consumer products.

    Another example of a service which will be frequently used not in very large numbers by 1975 will be the use of portable keyboard and printer terminals brought to the home for occasional use to access computer systems over the home telecom line for after hours work and for student (both school-age and adult) use at home. These requirements will grow from their current very low level to a substantial volume during the next decade or so, as varieties of computer systems become available and as human familiarity improves.

2. Requirements of Commerce and Industry

THE SO-CALLED INFORMATION EXPLOSION IS HAVING MAJOR IMPACT ON COMMERCE AND INDUSTRY, IN TERMS OF IMPOSING ADDITIONAL DEMANDS ON MANAGEMENT. There is an active search under way, much of it undefined to date, to find means of faster and better information transfer.

Realization of these underlying needs has been resulting in a great deal of work on business information systems within many organizations. This activity has had, as an ultimate goal, the development of what has been termed the total management information system. Up to the moment, few organizations have even come close to attaining this goal. During the next decade the cumulative effect of what has and is being done will bring more of these systems much closer to the concept of a true management information system.

The period to 1975, therefore, will be one during which there will be much re-evaluation and re-definition of objectives and the application of methodology. In addition much solid work will be directed towards keeping organizations in step with the demands of the changing socio-economic environment. These investigations and activities will be essential evolutionary steps in preparation for future change.

THE PERIOD WILL BE ONE OF EXPERIMENTATION AND INNOVATION, RATHER THAN ONE OF MAJOR CHANGE IN THE TELECOM REQUIREMENTS OF COMMERCE AND INDUSTRY, ACCOMPANIED BY THE FEELINGS OF RESTLESS DISSATISFACTION WHICH MAY BE EXPECTED DURING SUCH A RE-EXAMINATION. External effects such as changing world trade patterns, inflation, political and fiscal problems, as well as the internal changes, will contribute to the uncertainties within all of the many organizations which are affected by ongoing social, economic or technical change. Out of this process, future needs will be clarified during this period, in gradual steps. The objective of the telecom industry will continue to be to anticipate emerging needs and to respond to them as quickly as practicable.

To be more specific about the telecom requirements of some of the major segments of industry and commerce, we would expect some of the following developments:

The transportation industry (accounting for about 16% of total Canadian employment) - including automotive, rail, air and water transportation will continue to be a leader in the use of telecommunications and to pioneer in the use of new modes of voice, visual, and data telecoms. This is a result both of the widespread public use of their services and of the consequent social and technical complexity of their systems. Transportation and telecommunications tend to be highly complementary. Each, for certain purposes, can substitute for the other. Both bridge distances in the effective manner which is necessary for the cultural, social and economic development of a country such as Canada. Neither could grow optimally, to the public benefit, without the other.

The telecom requirements of the transportation utilities change radically over time as their transportation systems change, largely because they affect and are dealing with such large numbers of the public. New transportation systems must be preceded by major and expensive research,

development and trials. Only then can economic feasibility and public acceptance be determined. During the period to 1975, much important planning will be done, including identification of their future telecom needs, which will result in later change. Examples are planning for jumbo jets and supersonic aircraft and initial mass urban transit experiments. The telecom industry will continue to follow the developments actively and meet these changing needs.

The wholesale and retail merchandising industry (about 6% of total employment) will continue to search actively for improved management control, distribution, inventory control, and other operating methods. Much of this will include implementation of and additions to computer based systems. By 1975 there will be experimentation and some initial systems directed towards use of point-of-sale telecommunications. A few may establish systems encouraging customers to order goods from homes using Touch-Tone or similar techniques.

The construction industry (about 7% of employment) will be affected by the high rate of family formation which in turn will affect requirements for both housing and other construction. The growing variety of choices of materials and equipment available for use will cause a serious industry attempt to further develop a useful data bank of building materials. This would be accessed by builders by telephone or other telecom media. This development may occur by 1975 or shortly thereafter. Some portions of the industry will also be using visual telecom display devices accessed over their telephone lines or other telecom facilities for design and computation purposes.

The food and beverage manufacturing industry (about 6% of employment) will have evolving telecom requirements similar in many respects to the merchandising industry, with emphasis on inventory control and improved distribution methods.

The financial services industry (about 6% of employment) is facing the problem of the growing volume of transactions and the increasing cost of manual processing. A great deal of progress has been made in developing automated systems. This effort will continue during the period to 1975 leading to ultimate on-line banking systems. Some banks already have teller terminals linked by telecom to central processing bureaus. This will be substantially expanded and developed by 1975. Use of automated methods by which their customers will obtain their banking services from home over the telephone and other networks through local or regional computers are not expected to develop, except experimentally, within this period.

The mining, oil and refining industry (about 3% of employment) will continue to develop and improve their telecom use during the period but major change is unlikely. More use will be made of telemetry and process control systems, but many of these will be in-plant and require little telecoms. Major companies will continue to be important data users over the telecom carriers'

networks and these uses will have normal growth. Needs for rapid flow and analysis of data between exploration and drilling sites and central locations will be met by greater use of telecom network facilities accessed by teleprinters or similar terminal services.

The iron, steel and metals manufacturing industry (about 6% of employment) will improve their in-plant systems but radically different new telecom requirements are not foreseen at this time. This industry's plant tend to be large without widespread geographic dispersion, which affects their telecom requirements.

The wood product industry (about 6% of employment) is quite dispersed with bush and plant operations usually separated from the head office location. This results in a growing requirement for information flows (both voice and data) in both directions. It is expected that the amount of such information and the use of telecom services will continue to grow.

Additional needs of Commerce and Industry are identified in our reports to the Telecommission under Information and Data Services, Section 5, (d) and (e).

3. Requirements of Government

The size, geographic dispersion, specialized needs, and the normal management span and control requirements of governments will result in continued heavy reliance on telecoms for economy and efficiency of operations. The scope and variety of telecom requirements vary widely, of course, between municipal, provincial and federal governments, and may best be illustrated by a few examples, such as:

- progress towards defining and developing the communications requirements for real-time operation of certain welfare and health services, financial and treasury services, and law enforcement;

- the changing nature over time of national defence systems and requirements;

- the impact of people on the move - affecting federal, provincial and some municipal governments - including the requirements of airport systems, with the coming of jumbo and supersonic aircraft, mass transportation needs, and future major highway communications.

The foregoing is, of course, far from comprehensive but serves to illustrate areas of investigation for continuing study and planning by governments and telecom carriers during the next few years.

4. Requirements of Education

There will be continuing research and experimentation in how to improve the quality of education. By 1975, the peak of the current school enrolment wave will have flowed through the primary schools and a few years later through the secondary schools. A smaller portion of school budgets will be needed for new school construction and equipment. This may leave more funds available which should permit expanded use of technical aids for learning and teaching.

One of the problems is how best to serve the educational system in the 70's as it responds to the force of the "knowledge explosion". Improved techniques of information transfer have both social and economic implications. Analysis of the cost-benefit relationships is complex.

The impact of these factors upon telecommunication requirements will be significant. Identification of potential needs will result in testing and developing new services in the areas of closed circuit television, audio and audio-visual storage and retrieval . The Ottawa Information Retrieval Television (IRTV) experiment is an embryonic concept of one such system. There will be more extensive use of computers in education. Computer systems will be shared by many schools as communication services close geographical gaps and make possible integrated systems. This sharing principle will meet the needs of each school for a better and less costly system than would otherwise be possible. These systems will be used for school administration as well as making possible introduction of instruction in computer principles and technology. Automated inquiry systems will be developed which will search a computerized catalogue and advise a teacher of the audio-visual materials available. Students will use computers from remote terminals for problem solving, computation, information retrieval and other types of computer assisted learning. Some will be accessing their school's computer from home during out-of-school hours using portable terminals and their home telephone line.

Much of the foregoing will not have occurred on a wide scale by 1975, but a solid preparatory start will have been made.

C Telecom Plant Requirements

1. Construction Program

To meet telecom requirements it is estimated that the industry will require capital expenditures of approximately \$6.0 billion in the period 1970 to 1975, inclusive. The 1970 requirement of approximately \$700 million may rise to \$1.5 billion in 1975 in current dollars.

These estimates constitute the capital expenditures required for additions, improvements and replacement of the plant and equipment needed to provide existing and new services to present and new customers. The industry must carry on a continuing program of construction - extending, modernizing, innovating, and keeping in step with accelerating technological development.

Most industries have considerable choice as to the size and timing of their growth programs. The telecom industry has much less choice. Its program must be maintained at a level dictated by demand for service where and when required by people and businesses as they move and increase in numbers and size. Construction expenditures will increase year by year and must do so to provide service of a quality and in the quantities and varieties which will be commensurate with the future economic, social and industrial growth of Canada. The industry must ensure that planning done today will meet the needs of the seventies and eighties.

Continuity of service, survivability of plant, and alternate routing in the event of emergencies or other disasters, are included in the industry's planning for growth.

The level of the construction expenditures is determined by:

- replacement and movement of plant in service.
- growth in demand for present and new service offerings.
- innovation and modernization.
- the trend of inflation.

Highlights of some of the geographic and other considerations involved in the construction program are discussed below:

2. Geographical Considerations

a) Growth of Metropolitan Centers

The trend to Canadian urbanization will continue, as pointed out by the Economic Council of Canada (4th Annual Review - 1967). Their projections include the effect of population shifts from non-urban, and also further migration from smaller urban centers to the very large ones.

By 1980, the urban population is expected to be over 20 million, an increase of about 6 million since 1966.

About 60% of the total population will live in the major metropolitan centers in 1980. This represents an increase of about 5.8 million people to 15.3 million from 9.5 million in 1966.

In addition to the 19 cities now in the metropolitan category (over 100,000 people), it is likely that an additional 10 cities will grow

to this size by 1980: St. John's, Saint John, Sherbrooke, Trois-Rivieres, Kingston, Oshawa, St. Catharines, Sarnia, Sault Ste. Marie, and Saskatoon.

The group of largest metropolitan centers will continue at least to include Quebec, Montreal, Ottawa, Toronto, Hamilton, Winnipeg, Calgary, Edmonton and Vancouver. By 1980, the combined populations of Vancouver, Toronto and Montreal will total 8 million people, almost one third of the total population; an increase of more than 3 million over 1969.

From a telecom viewpoint, a significant feature of this growth is that the rate of suburban growth is in most instances several times as fast as in the central cities although there are major telecom expenditures involved in core city renewal projects.

Suburban growth is rapidly expanding the distance across which integrated and complex switching and transmission networks must be provided, of a type which are primarily local rather than inter-city in nature. Extended area service plans have evolved to cover very large areas, and the needs and pressures are ever extending as these metropolitan complexes grow. This affects both types of new plant construction and the ratio of exchange to toll revenues. As an example, by 1975, it is expected that there will be continuous urban development along Lake Ontario from west of Hamilton to east of Oshawa. There are obvious limits on the extent to which the needs and wishes of customers can be reconciled with costs and people's ability and willingness to pay for an ever enlarging geographic scope of telecom service. These evolving needs are under active study and it is anticipated that substantial capital expenditure will be involved in any acceptable solutions.

b) <u>Changing Rural Character and Needs</u>

Accompanying the trend to urbanization, there are significant changes occurring in the non-urban scene. The total non-urban population is not expected to change substantially but their character and needs are undergoing fairly rapid evolution.

To summarize these changes, our studies show that in many parts of the country:

- the number of large farms is increasing quite rapidly;
- there is a decrease in the number of medium-sized farms;
- the number of small farms is remaining stable but are not viable economic entities and are not being farmed intensively. They are being converted to hobby farms

and part-time residences of urban dwellers or retained as a place of residence with the owner making his livelihood from employment elsewhere, often in nearby urban employment.

- there is continuing substantial growth in the number of people building on small holdings in non-urban locations. From a service viewpoint, their needs and attitudes are urban rather than rural. The same applies to the expanded recreational facilities being built in non-urban territory.

The effect of these changes is that increasingly customers in the non-urban areas are ordering urban type telecom services. In many cases they are not satisfied merely by a reduction in the number of people served by a multiparty line. Those who had urban service before migrating to the non-urban location often will not accept multiparty service even temporarily. The impact of this on new construction during the next few years will be most substantial.

c) The North

It is anticipated that there will be further significant requirements for northern communications. New oil and mining exploration and development will occur and create needs for new flows of information. Telecommunications availability will assist in shaping the nature of these activities. While costly, northern telecommunications will be important to the social, economic and technical development of the potentials of these regions.

The potential of a domestic satellite to access remote regions will be an important addition to the networks serving the north. For elaboration on this subject please refer to our Telecommission report Section 8 (c) - Communications and Northern Development.

3. Other Factors

a) Circuit Requirements

Substantial increases in inter-city circuits will be needed. For instance, to meet all the voice, data and various wide band requirements, such as Picturephone (R) it is estimated that the required network capacity will have to be more than doubled over the next 10 years (as it was in the past 10 years).

It is expected that new heavy route coaxial systems will become available by 1975 or shortly thereafter and will be needed on certain cross-sections. These will provide economies of scale, to the public benefit through decreasing unit costs, provided that the aggregation of demand is sufficient to justify their high initial cost.

b) Changing Transmission and Switching Systems

Throughout its history the telecommunication network has evolved to keep pace with changing customer requirements. The needs have changed considerably over the past years as voice transmission has become increasingly imperative to our way of life. More recently, data transmission needs have evolved, and are changing and growing as users harness the potential in this medium. Around 1953 and 1954 television capability was added and in later years this was modified to allow the addition of broadband computer facilities for the interchange of core memory at very high speeds.

In the extensive trunk system embraced by the telecommunication network, much work has been done in analog carrier systems. On these, all voice-type circuits have been modified through the addition of interface equipment to allow their use for machine to machine transmissions, such as teletypewriter, time-shared computers and the like. In the last decade, pulse code modulation techniques have been incorporated in telecom plant following the development of transistor technology which made their introduction possible. Digital or pulse code modulation facilities offer greater utilization of the bandwidth available in any given channel. These systems are being used extensively in intra-city trunks and will be used on longer circuits as suitable designs are developed.

In the future, transmission systems will probably be predominantly digital although significant numbers of analog signal circuits will remain in plant to meet specialized usage and to permit the transition to be done in an economic fashion.

The evolution of switching systems is also indicative of the incorporation of modern technology into telecommication plant. New stored program control offices which are becoming available provide new features to meet present and developing needs for inter-communication between users, whether they be machines or people.

D POSSIBLE CONSTRAINTS

As a general comment it may be stated that the industry is capable of meeting the nation's requirements in the years ahead, as it has in the past. The basic objectives, attitudes, business goals, and raison d'être of the industry are tuned to its public utility role and to the expectation of continued Canadian development. THE BEST ASSURANCE THAT CANADIAN NEEDS WILL CONTINUE TO BE MET FOR THE FUTURE IS FOR ALL CONCERNED TO MAINTAIN AND FOSTER POLICIES WHICH AVOID ANY UNNECESSARY CONSTRAINTS AND RESTRICTIONS AND WHICH ENCOURAGE THE CARRIERS TO MAINTAIN HIGH PERFORMANCE. Growth to date can be measured on many bases including invested capital, physical plant,

construction programs, or revenue growth, any of which are reasonable indicators. Telephones, for example, have grown from about 1.5 million to 9 million in the past 30 years, and telex grew to 19 thousand in less than half this period of time. This kind of performance can be continued into the future given the above encouragement. Possible problems and constraints of the future may be outlined more specifically under the following headings:

1. Physical Capabilities of Telecom Carriers or Manufacturers

In general, the required technologies and physical capacities or potential capacity are available. Distance and geography, competition from foreign manufacturers, and the relatively low volume Canadian markets have been and will continue to present a challenge. This can be surmounted principally by selecting the most economical solutions resulting from research and development programs and by the types of innovative applications which have always been essential in the Canadian scene.

2. Managerial Limitations

The problem of span and breadth of control and limits of human capacity is, to quite a degree, an organizational question. Over the years, within the industry, there has been continued change and reorganization to meet the requirements of growth.

Organizational efficiency will continue to need and receive a great deal of attention. The process will be aided by new control techniques and capabilities, such as improved test centers and other plant innovations, new analytical techniques which are becoming available, including computer based systems, and improved human skills resulting from educational and training programs.

Considerable emphasis is being directed towards the continuing development and application of the results of research in the behavioural sciences on managerial and employee motivation. Appropriate methodologies are used and plans are currently under way which anticipate future manpower requirements.

An important facet of this question for the years ahead is that the industry's growth and earnings prospects must be good, from the viewpoint of meeting national telecom needs, in order to attract and retain a continuing inflow of capable people.

In general we are confident that the managerial skills which have brought the industry through its past 90 years of expansion can be developed to meet the challenges of the future.

3. Financial Limitations

Growth and development of the telecommunications industry depends, to a much larger extent than is true of most other industries, on the availability of large amounts of capital. Merely to provide for the growth of existing services, using existing methods, requires massive infusions of new capital. The characteristic capital intensity of the industry is illustrated by the fact that a dollar of telecommunication revenues requires about three dollars of capital while typical industrial companies in Canada generate a dollar of sales from only about 85 cents of capital.

The capital requirements of the industry are further intensified by the need to continually improve productivity and service quality and to provide new services to meet evolving customer needs. While to a limited extent, capital spending on such projects or on normal growth can be deferred, such delays will be costly in terms of both service quality and operating expense. Not only will the benefits to customers of service or quality improvements be deferred, but the process of catching up in future is likely to require uneconomic compression or mistiming of the various phases of long term improvement projects. Continuous availability of adequate amounts of capital on reasonable terms is essential to permit the industry to meet its obligations to provide service (usually a charter obligation and a prime requirement of its regulatory body) at minimum long run cost to customers. The detrimental effects of any limitation on such capital availability are both inevitable and cumulative.

The industry's ability to attract sufficient capital to meet its requirements is dependent to a large extent on the regulatory climate in which it operates. The basic policy facing both the industry and its regulators is one of balancing future needs and the interests of tomorrow's customers against pressures today for minimum rates. If the pressures on current earnings are such as to raise the cost of capital over the longer run, or if they force deferral of needed capital spending, the result is likely to be unavailability of existing or new types of service and increased future costs, or both. REGULATORY POLICY MUST TAKE INTO CONSIDERATION, AS AN IMPORTANT ELEMENT, WHAT THE INDUSTRY WILL BE EXPECTED TO ACCOMPLISH IN THE NATIONAL INTEREST AND WHAT EARNINGS WILL BE REQUIRED TO DO SO, AS WELL AS CONSIDERING THE IMPACT OF CURRENT RATES. The consideration of future objectives is becoming increasingly important in the face of accelerating changes in technology and social complexity and should be given increasing weight in the regulatory process.

Continuation of recent inflation rates will also greatly intensify the impact of capital constraints on the industry's progress. Inflation has the dual effect of increasing capital requirements and, at the same time, increasing the costs of labour and capital. To a large extent, most

businesses are able to offset these effects through higher prices for their products. The telecommunications industry, being regulated, does not have this same flexibility to adjust its prices quickly in response to changing economic conditions. To enable the industry to maintain its competitive position in the capital markets, regulation must be continually sensitive to these changes, and must be able to respond quickly to the changing needs of the industry.

4. Interaction of Growth and Technology

The telecom carriers have evolved services which provide for a spectrum of human wants and needs over a range which might be considered to extend from the purely social to the fully utilitarian. Whether social or utilitarian or both, these services are regarded by society as desirable in the total complex of human aspirations. The carrier's role is not that of a prescriptionist who should determine what should or should not be offered. The public, as evidenced by demand and acceptance, must remain the final arbiter. A responsibility of the carrier is to assess public wants and needs as accurately as possible, and to ensure that the public is made aware of new services available on demand. As a general principle, the carriers have attempted to identify needs of customers, whether expressed or unexpressed, and within the limits of economic and technical practicability to find economic ways to meet them. These efforts recognize the existence of a dynamic business and social environment and the aesthetic as well as the utilitarian needs of society. Customers frequently find new uses for telecom services which have permitted them to change and improve the way things were done previously.

In most situations, latent demand exists above the level of effective demand representing the amount of goods people will pay at prevailing prices. In the case of basic telephone service and within local calling areas served by extended area service, the telecom carriers have been successful in meeting needs to the point of practically eliminating this normal latent demand condition. As pointed out previously, almost 100% household development has been achieved.

In the case of inter-city services, the dialing and transmission systems in use have provided the capability for extensive usage growth. The ready access to such capability at reasonable prices has been a major factor in growth of demand. This interaction of demand and technology, in meeting latent needs and in making possible new customer uses for new services, requires substantial expenditure for R&D, but remains the best way to ensure that the nation's telecom needs are met on a continuing basis.

PART IV - LONG TERM MARKET PROJECTION AND ANALYSIS

A Potential Revenues

The projection of long term market potential for the telecommunications industry to 1990 is based on the population, revenue and telecom growth, immigration and household formation assumptions in Part I of this report. In addition, consideration has been given to the impact of developing environmental trends and, in particular:

- the probable effects of the growing complexity of society and its institutions,

- the needs for more and better information flows to cope with the growing complexity,

- and increased capability to find good technical and non-technical solutions for potential problems.

These emerging trends and needs, make it a reasonable expectation that the average growth rate of the long term telecom market potential should be at least as great in the future as during the past 15 years, or since about 1955. This has averaged just under 9% per annum in terms of revenue dollars. In comparison with this period, the growth rate averaged 12% during 1946-50 and 8% for the period 1926-67.

Based on the foregoing general premises, our estimates of the long term market potential are shown in the following table along with data from past years for comparison purposes. All figures are in the current dollars of the year shown. Comparable constant dollar data for the industry are not available.

Table 8

Long Term Telecommunications Market Potential

Year	Revenues (in millions of current dollars)
1940	83
1955	416
1968	1,385
1980 Est.	4,000
1990 Est.	9,500

Source: TCTS/CN-CP Telecoms estimates.

Notes:

1. The revenue projection represent one point for each time period in a broad probability range of market potential.

2. The projection includes the effects of extrapolating to 1990 the influence on revenues of past inflationary trends.

3. Past and projected future rates of growth for the period shown in the table are very similar.

4. The potential future revenues include some indeterminate component of revenues which will accrue to other than the existing common carriers. It is not known at this time to what degree customers will elect to provide their own equipment in future. In the past most of the telecom equipment used has been provided by the carriers, but in future there may be a greater mix of carrier and customer provided equipment.

B Industry Evolution and Impact on Revenues

The estimates of \$4 and \$9.5 billion annually by 1980 and 1990 may be divided roughly and approximately into two categories:

- the first category represents the extension and evolution of existing telecom services in whatever form they may take by these dates. This would include basic telephone services and whatever may be the mutation of services such as Wide Area Telephone Service, Telex, Wide Band Services, Datacom, etc. As discussed previously, some of these services will have declining growth rates, while others or their successors, will continue to grow at above average rates. Annual revenue potential is estimated at slightly over \$6 billion by 1990.

- the second category includes new services which do not now exist and which cannot be defined at this point in time except in generic and conceptual terms. They are related to the emerging new needs of an increasingly complex society for more and better information transfer to serve utilitarian, instructional, recreational, or entertainment purposes. Many of these needs will have a visual telecommunications component. Many will be computer-based services. Some examples may include telecom applications of holography, teleprocessing, microforms and microfiche, common space visual telecom systems and well developed audio-visual retrieval systems. This component is estimated by 1990 at over \$3 billion.

The importance of future telecommunications and of information flows to the economy is implied by Peter Drucker * in his discussion of "the knowledge industries" in the USA:

"The knowledge industries, which produce and distribute ideas and information rather than goods and services, accounted in 1955 for one quarter of the US gross national product. --- In the late 1970's it will account for one half of the total national product. --- From an economy of goods, which America was as recently as World War II, we have changed into a knowledge economy --- But the statistics, impressive though they are, do not reveal the important thing. What matters is that knowledge has become the central 'factor of production' in an advanced, developed economy".

Some of these emerging information needs have been referred to in greater detail in our reports to the Telecommission under Section 5, Information and Data Services.

- - - -

* Peter Drucker - The Age of Discontinuity

(Harper & Row, Publishers, 1968)

C Relation of Telecom Industry to GNP

Table 9

Telecommunications Contribution to GNP
(in billions of current dollars)

Year	Estimated Telecom Contribution	GNP	Telecom as % of GNP
1945	.11	12	.9
1955	.34	28	1.2
1965	.81	55	1.5
1968	1.1	71	1.6
1980 Est.	3.1	181	1.7
1990 Est.	7.2	374	1.9

Source: Estimates derived from DBS historical data.

Notes:

1. The Estimated Telecom Contribution to GNP is derived from the telecom industry's operating revenues less indirect taxes and the cost of materials, supplies, rents, etc. to show the gross value added contribution to GNP by the industry.

2. Growth in value of GNP, shown in the table, is estimated at 7% for 1970, at 8% to 1980 and at 7.5% to 1990. Of these amounts, growth in volume of GNP is estimated at 3.5% for 1970, at 5% to 1980 and at 4.5% to 1990. The slightly lower rate after 1980 is mainly because of anticipated lower labour force growth.

3. The relation between GNP and the telecom industry shown in this table serves both as an indicator of the reasonableness of the market potential projections and as a co-determinant of the market potential shown in Table 8. In the long term view, economic indicators such as GNP may be a more valid determinant than growth rates. This recognizes that the nature and amount of future services and the effective demand level cannot be assessed precisely.

4. This table tends to illustrate that there is a reasonable relationship between the past and projected future trends of revenues, growth rates and the industry's potential contribution to GNP. This view is reinforced by consideration of the known environmental forces (social, technical and economic) which are present in our society and underlines the growing dependence of the country as a whole on good telecommunications.

D Long Term Service Requirements

Some of the evolving shorter term telecommunication requirements were outlined in Part II. This section is to provide some further general comments and premises about the evolution of telephone needs to 1990 as a prelude to considering the roles of research and the impacts of social change:

- The environmental demands for information transfer will increase rapidly over the next 10 years. The world will be doing much of today's job in different, communications-oriented ways.

- Development of the management sciences and applied operations research with the computer as a tool will add new dimensions to human scope. Prior to 1990, these sciences will have progressed to the point of causing fundamental changes in organizations and their capability of coping with the complexities of systems and social needs. These "fourth generation" computer systems will have extensive network telecom requirements.

- There will be considerable expansion of telecom networks and improved capability for:

    - Instructional television
    - Industrial television
    - Community antenna television
    - Medium-to-high speed data, 4 K b/s-1.5M b/s
    - Very high speed data, above 1.5M b/s
    - High speed facsimile
    - Touch-Tone for data access and input to information banks
    - Picturephone and other visual display and retrieval
    - Video switching in central offices
    - Intercity conference television
    - Transmission to and from data banks
    - Banking systems with reduced cheque and paper flows

E Role of Research and Development

To accomplish much of the foregoing, a great deal of imaginative innovation will be necessary, supplemented by a strong research and development program.

Telecom systems and networks have evolved to a highly complex stage of development. One effect of this complexity is the high cost of acquiring the new knowledge necessary for the further progress continually to be required. This stems partially from the number of years of lead time necessary to identify, plan, develop, produce, introduce and gain economically viable levels of market penetration for services to meet

emerging needs. The continuous expenditure for R&D by the industry has resulted in constant improvement in the value of service offered and can do so in the future. The level of earnings and the supply of capital necessary to the accomplishment of R&D programs to meet customers needs of to-morrow, are permanent requirements for progress.

In this environment of change, suitable research and development roles and objectives for Canadian telecom research organizations may be summarized as:

1. Cost reduction programs directed to finding better and less costly ways of doing things. In addition to the benefits to users, these programs can result in building a competitive Canadian manufacturing industry in accordance with accepted national objectives.

2. Meet uniquely Canadian needs when use of imported technology is either impractical or not available.

3. Meet emerging new needs in the fashion most appropriate to the Canadian environment. As a by-product, this also maintains Canadian talent banks, as an essential ingredient of the quality of telecoms which will be required and which nationally we have come to expect.

F <u>Impact of Social Change</u>

The nature of research and development programs will be profoundly influenced by evolving social change.

Social change, together with the so-called information revolution, and the needs of the evolving "post-industrial" society, will require more elaborate programs of motivational, market and social research than have been necessary in the past. This will be directed towards meeting identifiable needs efficiently and as promptly as practicable.

On such a broad subject as social change it seems most appropriate for this report to confine discussion to phases which have direct telecom orientation. This includes such areas as:

1. Urbanization - changing patterns of land use and the degree to which people's aspirations can and will be satisfied. This was discussed at greater length earlier in the report.

2. Affluence - the trend to higher disposable and discretionary real incomes and the resultant impact on people's value attitudes towards services including certain categories of telecoms.

3. Mobility of people - relating both to affluence, social and economic structures, and new information flows.

4. Continuing education - including the facilities for pursuing learning both for pleasure as well as for occupational reasons throughout a lifetime.

5. Some recreational and entertainment trends - this may include both pure entertainment as well as continuing education for pleasure. Some researchers make a distinction between mass media, defined as a one-way spread media disseminated over an area, and communication media, which are two-way and involve interaction and response. Critics of the mass media have foreseen increasing homogeneity among the population due largely to the one-way characteristic.

6. Organizational choices - new transportation, communication and power technologies may not cause dispersal of peoples but the technological capability will exist. The question is to what degree people will want dispersal and react against metropolitanization. Dispersal may become an important trend because of the enormous costs and social penalties involved with congestion, and may have an enormous new impact on telecoms.

7. Medical and health trends - this includes the effect on mortality rates and population densities of socially oriented health research and technology. Hospitals and physicians' operations are being computerized. The question is the degree of impact on remote diagnosis, prescription and treatment services, together with the levels of people's acceptance of these potential methodologies.

The foregoing are seen as some of the most probable social trends impacting on telecommunications. They serve to illustrate the basic process of the interaction of social needs, values and beliefs on available resources. Only after a period of interaction, often involving controversy, does a value attitude emerge which produces identifiable needs and action. As this occurs, it will be important that the telecommunications industry be capable of moving quickly with the resource components to meet the need.

Trans-Canada Telephone System/Canadian National-Canadian Pacific Telecommunications

March 1970

TELECOMMISSION

Study 2(f)

Corporate Ownership and Integration in the Telecommunications Industry

The Department of Communications

Report of Telecommission Study 2(f)

CORPORATE OWNERSHIP AND INTEGRATION IN THE TELECOMMUNICATIONS INDUSTRY

Available by mail from Information Canada, Ottawa,
and at the following Information Canada bookshops:

HALIFAX
1735 Barrington Street

MONTREAL
1182 St. Catherine Street West

OTTAWA
171 Slater Street

TORONTO
221 Yonge Street

WINNIPEG
393 Portage Avenue

VANCOUVER
657 Granville Street

or through your bookseller

Price 75 cents Catalogue No. Co41-1/2 F

Price subject to change without notice

Information Canada
Ottawa, 1971

This Report was prepared for the Department of Communications by a project team made up of representatives from various organizations and does not necessarily represent the views of the Department or of the federal Government, and no commitment for future action should be inferred from the recommendations of the participants.

This Report is to be considered as a background working paper and no effort has been made to edit it for uniformity of terminology with other studies.

TABLE OF CONTENTS

I. INTRODUCTION

Efficient resource allocation, reasonable prices, response to consumer interests and innovation are aspects of the public interest in telecommunications[1/]. This study seeks to provide some of the basis for decisions as to how they might be achieved.

Before attempting to describe an industry for the purpose of competitive or related analysis, that industry should be defined. In the case of telecommunications several factors combine to make the dimensions of both product (or service) market and geographical market complex and unstable. For example, recent and well-known scientific discoveries have altered the relationship between artifically guided and unguided signal transmission techniques, between different forms of each of these two general techniques, and between computer and communications technology. Lower tariffs and improved international communications links are diminishing the significance of political boundaries. For some purposes the relevant industry definition is broad and for others it is narrow.

1/ The elusiveness of any detailed concept of "public interest" becomes apparent from even a superficial reading of government, industry and independent literature. Different groups have different priorities, all of which have some claim as being part of the national interest even though, in the context of telecommunications, they may not be entirely compatible. Among the priorities implicit in one or another of the studies on various aspects of communications are the following:

(a) keeping east-west transmission networks busy (i.e. communications among Canadians);

(b) retention of Canadian data and computer power in Canadian hands (sovereignity, growth, prestige);

(c) encourage computer utilization in Canada;

(d) retain Canadian talent;

(e) maximize Canadian ownership in Canadian production, especially in technologically advanced and rapid growth sectors;

(f) encourage efficiency and progressiveness in the use of Canadian resources;

(g) preserve competition where appropriate.

Other Telecommission studies deal in depth with industry ownership, structure and control problems of mass communications (e.g. broadcasting and cable television) and computer/communications systems. As to the latter, forward vertical integration by carriers into data processing was discussed by a Departmental paper published recently2/ and will receive further attention at the hands of a comprehensive task force study of all aspects of computer use in Canada. Accordingly, this report will limit its focus to intercommunication transmissions (primarily wire) and to communications equipment manufacturing. Part II describes the main elements of those industries in Canada with details of corporate structure, ownership and control. Part III reviews some economic implications of monopoly, vertical and horizontal integration, and certain types of trade practices. Part IV examines briefly some of the broader features of designing an effective control structure to secure the public interest goals.

In a study designed to explore the need for public institutional capacity to deal with problems of competition and industry performance if, as and when they arise, there is a risk of creating an impression of opposition to the existing industry. It must be understood, however, that this study only seeks to identify and discuss issues in the abstract; and in any event it is not based on nearly enough detail to permit a judgment one way or the other on existing specific situations. Accordingly, no such judgment should be inferred. At the same time, free use has been made of available public information from both Canada and the United States to illustrate at least potential problems.

In considering the Canadian telecommunications industry from the point of view of optimum structure and performance in the future, one should retain full awareness of the pragmatic way in which the industry has developed over the last century to meet Canadian needs. Also, it is well to remember that economists, who have written most extensively on the subject matter of this study, tend to be cool toward monopoly, vertical integration and regulation. They would however be the first to agree that the science of economics is not capable of accommodating all the relevant values and aspects of the public interest in telecommunications. In fact, the Canadian industry is distinguished by a remarkable level of technical and economic achievement by international standards.

This report has been prepared largely on the basis of contributions and advice from the Department of Consumer and Corporate Affairs.

2/ Participation by Telecommunications Carriers in Public Data Processing (Department of Communications, Government of Canada, June, 1970). The present study ignores the difficulty of determining how much message switching is necessary to classify a service as "communications" rather than "data processing". The instability of industry definitions in this area should however be recognized.

II. INDUSTRY STRUCTURE AND OWNERSHIP

Telephone service in Canada is provided by enterprises each possessing a monopoly of telephone communications within a geographically restricted area. The Canadian switched network for voice communications is not co-ordinated by one body possessing ownership control. Both government-owned organizations and private enterprise participate in the industry. Many companies serve very small, usually rural markets, some offer virtually province-wide services, while the operations of one company extend over most of the area of the two largest provinces. Co-ordination and integration of the operations of the various telephone carriers has been achieved by means of agreements among the companies and by the influence of industry associations. In addition, government regulatory bodies supervise some of the activities of the telephone companies to protect the public interest.

Bell Canada, a widely held, Canadian-owned corporation is by far the largest participant in the industry. It obviously exerts a great influence over the quality of telecommunications in Canada. Bell controls virtually all telephones east of Manitoba, either through its own operations or through those of its subsidiaries. During the 1960's Bell Canada management carried out an active acquisition policy, buying many of the major independent companies in eastern Canada. Appendices A and B provide some information on the size and scope of the mergers. The only major company in eastern Canada not under Bell's ownership control is Quebec Telephone, which is controlled by General Telephone and Electronics of the U.S. (see Appendix C). In the case of Maritime Telegraph & Telephone, the Nova Scotian Government intervened and prevented Bell from exercising voting control despite its ownership of a majority of the equity shares.

Continental Telephone Corporation is the fourth largest of about eighteen hundred independent telephone companies in the United States. Its Canadian holdings are set out in Appendix D. The second and third largest American independents, United Utilities Incorporated and Central Telephone Company, have no significant Canadian holdings.

Appendices E, F and G indicate the relatively large size of Bell in the Canadian telephone industry. If statistics were given showing transmission traffic by company (e.g. number of calls, or volume of data transmission), Bell probably would loom even larger because its operations cover many areas with large populations and extensive commercial and industrial activities. Bell Canada owns 61.8% of all telephones used in Canada and 84.0% of all those used east of Manitoba. Bell, together with the other companies with which it is associated, accounted for 69.4% of Canadian telephones in 1968 and for 94.4% of the telephones in eastern

Canada. The market shares statistics in Appendix F do not have the usual significance of concentration statistics since the telephone companies are protected by government from direct competition. The ratios are useful, however, in indicating the bargaining power of the telephone companies as buyers and sellers in other markets (telephone equipment, for example) and in dealing with one another3/.

None of the large telephone companies is involved solely in public telephone service. Technological developments have increased the variety of techniques of transmission and the applications of transmission services (i.e. the forms in which "messages" are sent, the speed at which they are transmitted, and the processing which they undergo). The long distance carriers are involved in television and radio program transmission and they variously offer radio-telephone and Centrex systems, TWX teletype and broadband services4/. While so-called "private wire services" currently constitute a small part of the telephone carriers' operations, this segment of business is expected to grow very rapidly. Growth in the transmission of data into and between computer facilities has contributed to the increasing importance of private wire services. In these services, the telephone carriers compete with the telegraph and cable companies (i.e. CN/CP). The share of the growing data transmission business to be obtained by the telephone companies will partly depend upon their continuing ability to adapt to the requirements of this traffic and on whether or not the carriers are allowed to integrate forward into computer services.

Bell Canada also wholly owns Northern Electric Company Limited, the major telecommunications equipment manufacturer in Canada5/. Until 1956, when a consent decree in the United States forced certain changes in policy by the Bell System, Western Electric, the manufacturing arm of the System, held a large percentage of Northern equity. In 1957 most of this share was sold to Bell Canada. The remaining 10% held by Western was purchased by Bell in 1962.

3/ In activities which are regulated, of course, the bargaining power of a carrier may be offset by the regulatory body.

4/ Exhibit B6-26, introduced by Bell Canada at the 1969 Rate Hearings Before the Canadian Transport Commission, contains a description of the telecommunications services offered by that company.

5/ Northern has incorporated Micro-Systems International Limited. This company is involved in the research, development and production of micro-electronic circuits and hopes to become a major world supplier particularly in the telecommunications sector. See Financial Post, Dec. 6, Dec. 20, 1969.

Bell Canada has maintained a Service Agreement with American Telephone and Telegraph Company of the United States under which it obtains the results of telephony research, engineering assistance, non-exclusive patent licenses and other benefits[6].

In late 1970 the large Northern Electric R & D establishment, previously influenced and partly financed through Bell-Northern agreements, was separately incorporated as Bell Canada-Northern Electric Research Ltd. The new company is 51% owned by Bell and 49% by Northern.

Bell Canada's ownership of Northern is important to the telephone company's operations. Northern produces a complete line of transmission equipment, telephone apparatus and switching and terminal equipment[7]. While Northern enjoys a captive market in Bell Canada, its sales are not restricted to Bell or Bell-owned telephone companies. Non-Bell Canada sales, including exports, account for almost half of Northern's revenue from communications equipment. Since the B.C. market is largely closed to Northern, the companies operating on the prairies appear to be the largest domestic market outside Bell territory. Northern's major rivals in the communications equipment market are foreign manufacturers (such as Siemens, Ericsson, Plessey), Canadian subsidiaries of Automatic and Lenkurt and, for some equipment, the large, diversified electrical goods manufacturers.

The second largest telephone company, British Columbia Telephone, and Quebec Telephone are both controlled by the second largest U.S. telephone company, General Telephone and Electronics Corporation, through its holdings in the Anglo-Canadian Corporation. In the United States, General Telephone has been active in acquiring companies and diversifying its operations. Not only has it taken over other independent telephone companies and telecommunications equipment manufacturers, but it has also integrated forward, moving into data processing[8]. Lenkurt and Automatic Electric, both equipment manufacturing subsidiaries of General Telephone, have established plants in Canada. B.C. Telephone purchases most of its requirements from these affiliated companies but Quebec Telephone, a more recent acquisition of General Telephone and Electronics Corporation, does not seem to have acted as a "captive market".

6/ Further information about this Agreement was given at the 1966 rate hearings before the Board of Transport Commissioners.

7/ See Appendix B. Northern also produces non-communication wire and cable and has a wholesaling operation.

8/ See Business Week, Nov. 22, 1969, p.97.

Quebec Telephone is the only major telephone company which has entered into the computer field. It currently offers bulk processing services and is considering provision of time-sharing services9/.

Each of the three prairie provinces has set up a publicly owned telephone system. None of the organizations has a captive supplier although the provinces have used their purchasing power to persuade equipment manufacturers to set up plants in their territory. In addition to these large companies, there are a considerable number of small independent operators and some municipal companies. About 2,000 telephone companies exist in Canada10/. Most are members of the Canadian Independent Telephone Association, which represents their common interests. Other associations which include small companies in their membership are the Quebec Independent Telephone Association, the Ontario Telephone Association, and the Saskatchewan Association of Rural Telephone Companies.

Co-ordination and integration of the networks controlled by the various organizations is essential for long distance telephone, television and radio transmission, data and defence communications. Two voluntary associations are the vehicles by which the major telephone companies agree on the technological and financial considerations required for effective integration of the Canadian network. The Trans Canada Telephone System, established in 1931 and composed of eight companies, deals with matters affecting long distance communications11/. Working on the basis of unanimous agreement, the system is set up so that each member company provides the plant within its own territory (and deals with other companies in the territory) and shares in the revenues from communications carried into, out of or across its territory. The Telephone Association of Canada includes the eight TCTS members and five of the larger remaining telephone systems. It was formed in 1921 "to promote co-operation and the interchange of technical and operating information within the telephone industry"12/.

9/ All the major telephone carriers possess substantial computer capacity which is used for internal purposes at present. Bell Canada has also indicated interest in offering data processing services.

10/ D.B.S. stated that the total number of telephone companies which could have returned its questionnaire for 1968 (for Telephone Statistics) numbered 2,067.

11/ See Appendix H for list of members of the Association.

12/ See The Telephone Association of Canada, Canada's Telephone Industry in Perspective, 1965, p.9.

Canadian Overseas Telecommunication Corporation, a Crown corporation established in 1949, is responsible for maintaining and operating external telecommunications services by cable, radio-telegraph and radio-telephone and any other means. The corporation is involved in a Commonwealth cable system and communications satellites, for which it has built ground receiving stations as part of the Intelsat system. It is also a designated entity in Intelsat.

Nine telegraph and cable companies operate in Canada[13/]. However, the joint venture CN/CP Telecommunications is the most important organization in domestic record communications and its role is likely to expand as data transmission increases in volume[14/]. It offers Telex teletype and Broadband Exchange Service, which is a voice-data service inaugurated in 1967. Approximately 75% of CNT and CPT business involves data transmission. In 1969, CN and CP each purchased 25.5% of the equity of Computer Sciences (Canada) Limited (CSCL) from Computer Sciences Corporation of Los Angeles. The U.S. company holds a minority equity interest in CSCL and also controls Computer Sciences Leasing Canada Company. The following information on the American company is derived from Standard and Poors, Corporation Records, p. 4083:

> Company provides industry, scientific institutions and government agencies with computer services including consultation in the use of computers, business and scientific problem analysis and data processing, computer systems programming, systems and project management and the use of a Univac 1108 computer installed in May, 1967. Among services provided is an on-line accounting service to financial institutions from its Huntsville, Alabama computer facility. In January, 1969, Co. was planning to establish a transcontinental network of computer time-sharing centres. In fiscal 1968, about 85% of service revenues were derived from government contracts and 15% from industrial and commercial customers. Company has offices in a number of U.S. cities, in Alberta and Belgium. Among affiliates is Computer Sciences Canada Ltd. (49% owned), Ottawa, Ontario, with offices in Toronto, Calgary and Vancouver; provides computer programming and analysis services and operates a computer center at Calgary.
> American Co. incorporated in Nevada, April 16, 1959.
> Employees, May 30, 1968, 3,000
> In February, 1969, reduced interest in Computer Sciences Canada Limited from 100% to 49% by sale of 25.5% each to Canadian Pacific Ry. Co. and Canadian National Ry. Systems.

13/ Telegraph and Cable Statistics, (D.B.S. 1968).

14/ CN and CP both provide public message service; CN has telephone systems in remote areas as well as its telegraph operations. Northern Alberta Railways and Ontario Northland Railway both earn some revenue from telegraph and cable services. CP has an investment in the former company.

As of August 1, 1970, the private wire services as well as the public message services of federally regulated telecommunications carriers fall within the jurisdiction of the Canadian Transport Commission. The major companies subject to its jurisdiction are CNT, CPT, Bell Canada and British Columbia Telephone[15]. The Commission makes periodic reviews of the financial accounts of the carriers, hears submissions on tariff and rate changes by the companies and others and makes decisions binding on the companies. Provincial governments supervise the activities of the other carriers.

Equipment manufacturing and data processing activities of carriers, of course, are not regulated.

15/ Provincial governments, the CRTC and the Department of Communications have also been concerned with the activities of these companies. See financial Post, January 10, 1970, for two articles on Bell's dealings with government and possible changes in Bell corporate structure.

III. COMPETITION AND TELECOMMUNICATIONS

A. Aspects of Monopoly

To an economic theorist perfect monopoly is a situation where only one seller exists in a market. Buyers have no real alternative to paying his price. There are no competitive forces to drive prices down toward costs or to stimulate innovation. There are no forces of dynamic change. Price and output are set at levels which will result in maximum profit.

While perfect monopoly is more a theoretical model than ever an actual market condition, there are market situations where one firm is so dominant as to enjoy most of the benefits of monopoly power[16]. Accordingly, Canada's Combines Investigation Act defines the monopoly offence in section 2(f) by reference to "a situation where one or more persons either substantially or completely control throughout Canada or any area thereof the class or species of business in which they are engaged". In other words, the economic evil depends on relative size in a market rather than absolute size. A very small firm may be a monopolist and a very large one not.

It is possible to conceive of a private unregulated monopoly that is not harmful to the public interest, and monopoly only becomes offensive under the Combines Investigation Act if the persons in control "have operated such business or are likely to operate it to the detriment or against the interest of the public, whether consumers, producers or others". Where, for example, a monopolist creates unnecessary barriers to entry, or engages in exclusionary practices such as predatory pricing, his conduct would be offensive on the grounds of economic efficiency alone since he might have been challenged by a competitor who could give the consumer a choice and create pressures to induce better quality, lower prices and better response to consumer demands. Insofar as the "optimum" can be defined by reference to the wants of people, then, economists have long considered that competition (in the sense of effective consumer alternatives, rather than commercial atomism) is generally more likely to result in optimum long-run allocation of total productive and distributive resources.

Monopoly pricing may result in prices that are too low rather than prices set to maximize short-run profits. The social function of price and private profit is that by their rising in the short run as a

---

16/ Some economists also describe oligopolistic interdependence as "shared monopoly" or "group monopoly".

reflection of market demand, more resources will be shifted to meet that demand. If a monopolist prices his product just low enough that outside investment is not attracted into the industry, it is possible that the present value of the firm to the owners will be maximized. Assuming, apprehensively and statically, that no extra efficiencies could be introduced into the industry by innovation or otherwise, the possibility of future competition has then only limited capacity to force prices down toward costs and thereby to pass economies on to consumers. In short, the essential feature of "monopoly price" or "monopoly profit" is not its absolute dollar size, but rather the manner in which it is set or arrived at.

"Natural monopoly" is the economist's term for an industry where technological and market imperatives are such that serious resource misallocation would result from any market structure other than a single firm. This is the case where the absence of any relevant limit to economies of scale results in low unit costs which cannot be duplicated by new and smaller entrants. In these types of cases, of which the telephone industry and energy supply are the most familiar, the monopoly is usually subject to direct public control over certain business decisions and other aspects of industry performance. In the case of the telephone industry the tendency to natural monopoly turns largely on economies of scale and the wasteful duplication in local exchange and other facilities that would need to be installed to create effective competition. This does not prevent the growth of separate telephone monopolies in local areas and regions, and the requirements and standards of national interconnection are independent of the question of corporate ownership.

It is becoming less valid to regard voice communications as the only relevant service dimension of the industry. CNT and CPT provide, on a joint venture basis, telegraph and various data transmission services. CNT also provides telephone service in certain parts of the country, and Quebec Telephone offers a limited amount of public message telegraph service as an adjunct to its telephone service. As the telephone companies move increasingly into the data transmission field rivalry will emerge between the carrier systems. Moreover, it is conceivable that cable systems will become another substitute for some types of transmission. The debate over what constitutes "communications" and what constitutes "data processing" is a new development in the issue of natural monopoly versus competition in telecommunications. An issue in the satellite debates involved the corporate structure and ownership of the system and competition among alternative means of transmission.

B. Vertical Integration

The following discussion adopts the conventional terminology used in competition theory and analysis. Accordingly, the word "vertical" is used to describe economic arrangements between companies standing in a supplier-customer relationship, or activity by one company at more than one level in the production-supply chain. "Horizontal" is used when companies perform similar functions in the production or distribution of comparable goods or services[17/]. The word "integration" is used to mean a formal, structural corporate interest through ownership of shares or assets. In other words, it connotes something more than an informal or even a contractual arrangement between two companies.

In general, vertical integration has the following implications for competition:

1. By tying a customer to a supplier it forecloses the competitors of either party from a segment of the market otherwise open to them.

2. It tends to raise the absolute cost barriers to entry into the industry.

When one of the activities is regulated, of course, the central problem tends to become the extension of (regulated) monopoly power into unregulated markets, with all the attendant control difficulties.

Vertical integration can, however, lead to greater efficiencies through pooled management talent, lower production costs, more efficient distribution, and so on. Therefore, the economic desirability of vertical integration depends upon the facts of each particular case.

Issues of both forward and backward vertical integration are becoming common in the communications and information industries. Should cable companies be involved in program content? Should carriers be permitted to sell either computer processing or software services, or both? Should carriers remain in an integrated relationship with communications equipment manufacturers?

17/ The recent Departmental paper, Participation by Telecommunications Carriers in Public Data Processing, used the terms in a different sense to facilitate that part of its discussion which was based on the hypothesis that carriers become involved in data processing. The paper used "vertical" to denote carrier involvement through a legally and financially distinct corporate subsidiary, and "horizontal" to denote involvement through an expansion of the carrier company's direct activities.

Dr. M.R. Irwin, who has written extensively on this latter problem, summarized it as follows18/:

> "... vertical integration is the critical structural trait of the industry. Once integrated, the carriers take the bulk of their equipment in-house, with no competitive bidding; customers are prohibited from attaching equipment or systems to the local or toll telephone network; and customers must lease both apparatus and communication channels from the industry as a package. While the foreign attachment tariff has been modified to some extent when the customer leases his own circuits, both tariffs are rigorously enforced on the dial-up network. The carriers defend the structure and practices of the industry by arguing that (1) vertical integration results in equipment reliability, quality control, and a systems approach unmatched by alternative industry structures; (2) their purchases from supply affiliates are dictated by cost efficiencies unmatched by independent suppliers; and (3) the carriers must retain ownership of equipment and apparatus in order to ensure the quality and integrity of the nation's telephone network. In short, the structure and practices of the carriers allegedly redound to the benefit of the consumer in terms of optimum quality, cost, and service."

Specifically, the possible dangers of a carrier-equipment manufacturer tie are as follows:

1. High supply costs, often resulting partly from cost-plus pricing which relieves the manufacturer of pressure to keep production costs low, may be forwarded as part of the carrier's rate base. This has particular significance in a capital intensive industry.

2. Competition in the equipment manufacturing industry, which may be helpful to stimulate innovation, could be distorted or stifled by:

   (a) exclusive dealing by the carrier, which may result in sub-optimal output for independent manufacturers, with resulting high unit costs and prices;

   (b) non-competitive profits from carrier business may give the manufacturer a stronger competitive position with respect to other customers in that he can afford to meet or beat any independent's bid;

   (c) interconnection and foreign attachments policies by the carrier may favour its own manufacturer.

18/ Irwin, "Vertical Integration and the Communications Industry : Separation of Western Electric and AT&T", (1969) 3 Antitrust L. & Econ. Rev. 125, 131.

3. Determination of the rate base, rate structure, operating expense and rate of return for regulatory purposes is made more difficult and arbitrary, and some need arises for the regulatory body to attempt to assess the performance of the manufacturer[19].

For some years now an inquiry has been in progress under the Combines Investigation Act relating to the manufacture, production, distribution, purchase, supply and sale of communications systems, communication equipment and related products[20]. As reported by the Director of Investigation and Research[21]:

> "The inquiry is concerned primarily with: (1) the danger that the expansion of its regulated telephone business through the acquisition of other telephone companies may spread the monopoly power of Bell Telephone in non-regulated areas by enlarging the captive market available to Northern Electric, its wholly-owned subsidiary; (2) the danger that the monopoly power of Bell Telephone may spread in the non-regulated area through diversification by Northern Electric or the acquisition of other non-regulated suppliers while Bell Telephone continues to be in a position to provide such suppliers with a captive market; and (3) the danger that the monopoly power of Bell Telephone may spread by the control it is able to exert over the equipment which may be attached to its "electronic highways".
>
> "The inquiry was instituted as a result of the relatively recent acquisition by Bell Telephone of all the important telephone companies in eastern Canada."

Since 1912 Bell has been suppled by Northern under the terms of a supply contract. Completely revised in 1939 and amended in other respects since, the contract requires that Northern stock and distribute materials for Bell and that Bell is entitled to Northern's goods and services at prices no higher than Northern's prices to its most-favoured

---

19/ The Canadian Transport Commission, and the Board of Transport Commissioners before it, has reviewed aspects of Northern Electric's performance in Bell rate hearings. Likewise, the FCC reviews Western Electric's prices and profits in rate cases involving AT&T and the associated companies.

20/ The available detail on this investigation appears in Report of the Director of Investigation and Research, Combines Investigation Act, for the year ended Mar. 31, 1968, pp. 54-55.

21/ *Loc. cit.*

customers. This supply arrangement, typical of vertical ties in the telephone industry, has frequently been challenged before the regulatory body by interests who feel that it has a severe impact upon the competitive situation in the equipment manufacturing industry, with ultimate effect upon the value being received by telephone users.

Backwardly integrated telephone companies doubtless make some effort to compare prices and quality among equipment manufacturers before making major purchases, and to ensure that the costs being incurred by their manufacturing subsidiaries are as reasonable as possible. However, many factors favour their own manufacturers in the short term, and it would not be surprising if the tied manufacturer received preferential treatment even within ostensibly competitive situations. For example, it might be given a special opportunity to meet a lower bid submitted by another company.

At a rate hearing in 1950 before the Board of Transport Commissioners, three of the allegations concerning a supply contract between B.C. Telephone and another subsidiary of Anglo-Canadian Telephone Company were as follows: (1) that substantial sums paid out to holding companies were improvident; (2) that dividends were excessive, having regard to the enjoyment of monopoly and protection through regulation by the Board; and (3) that the telephone's company's relationships with other companies in the group were not conducive to economical operation and had a further effect of lessening its revenue. The Board came to the conclusion that the bulk of the revenue of the supply company was derived from the telephone company and that the expense thus incurred by the telephone company was excessive. The Board was of the opinion that it was not empowered to deal with the rate of return or the indirect benefits of companies affiliated with those over which it had jurisdiction, beyond satisfying itself that a reasonable payment only was being made by the telephone company for the services required. Nor did the Board think it to be within its powers to direct the telephone company to withdraw from the supply contract and establish its own facilities. The Board said that its concern was merely that the resulting rates for telephone service should be fair and reasonable. The Board concluded that the supply contract added an additional cost to the telephone company of approximately $117,000 which should not be taken into consideration as an item of expense to be borne by the telephone company's subscribers, and it ordered this amount to be deducted from the requirements of the telephone company that would be considered for rate fixing purposes.

In 1953 the Board, in the course of further hearings, considered the matter again. It considered it advantageous for the telephone company to have strong connections which would enable it to obtain needed equipment and supplies as and when required, particularly under the "sellers' market"

conditions which had prevailed during recent years and were then still prevailing. The Board considered that the supply contract helped to put the telephone company in this position. The Board was nevertheless of the opinion that, having regard to the affiliated relationship of the telephone company and the supply company, it was essential that their dealings one with the other be fully disclosed to the Board and that the prices paid by the telephone company be not more than were reasonable for the services rendered.

The Board then referred to its previous disallowance of $117,000 and noted that, subsequently, the charge of 3% on aggregate annual purchases in excess of $1,000,000 provided for in the supply contract had by mutual agreement between the companies been reduced to 1-1/2%, thereby effecting savings of $184,299 and $253,338 in 1951 and 1952 respectively. Referring on this occasion to a brief presented to the Board on behalf of a local association, the Board remarked that it had also been established that the supply company gave more favourable terms to the telephone company than to any of its other customers. The Board noted the complaint that the telephone company (through the supply company) purchased large quantities of telephone equipment and supplies from another affiliated company at what had been described to the Board by the complainants as non-competitive or monopolistic prices. "Whether or not a monopoly exists in the field of manufacture, distribution or supply of telephone equipment and supplies", said the Board, "is not a matter for determination by this Board nor is a decision on that question necessary for the purposes of this case. Moreover, even if there is such a monopoly, the Board has no reason to conclude that the monopoly would cease to exist or be changed by a refusal on the part of the company to enter into the Service and Supply Contracts or either of them; or that the Company could, by refusing to enter into these contracts and seeking to obtain necessary service and supplies by other arrangements or from other sources, obtain such services and supplies at less cost on the whole than it does under the existing contracts". The Board then stated that it had carefully considered the supply contract and the evidence and exhibits relating thereto and was satisfied that the prices paid by the telephone company under that contract "are not greater than reasonable and should on the whole be allowed as legitimate expenses".

It will be noted that the alleged combine differed from the usual pattern. It was not alleged that manufacturers or suppliers had agreed to limit production or fix prices; but rather, in effect, that the related companies, enjoying a public utility monopoly within the area of their operations, had agreed among themselves that telephone equipment would be manufactured or supplied within the group at non-competitive prices.

The Bell-Northern Supply Contract came under extensive review in the 1966 rate hearings before the Board of Transport Commissioners. The relevant Board conclusions were as follows22/:

> " On the evidence, the Board finds that, at this time, Bell's investment in Northern Electric is not in fact prejudicial to the interests of Bell's telephone customers; that the prices paid by Bell to Northern Electric are as low as or lower than going prices; that Northern's overall rate of return does not appear to be excessive in comparison with the general average of other manufacturing enterprises of a similar nature and in comparison with the rate of return earned by Western Electric in the United States; that the rate earned by Northern on its Bell business is lower than the rate of return earned by Northern on its non-Bell business; that the rate of return earned by Northern on its Bell business is not unreasonable and not much higher than the rate of return earned by Bell as a utility; and that the Board is not of the view that Northern's rate of return on its Bell business should be limited at this time to the rate of return which the Board finds reasonable for Bell."

The conclusion that "the rate of return earned by Northern on its Bell business is lower than the rate of return earned by Northern on its non-Bell business" was reviewed for the judgment on the 1969 rate hearings with the assistance of accountants, and the Canadian Transport Commission concluded "that on the average the situation remains substantially as described in the 1966 Judgment"23/.

Even with the assistance of such comparative statistics as are available24/, analysis of Northern's performance is immensely difficult. Given the structure of the industry, it may say little about the desirability of Northern's prices to Bell to compare them to non-Bell business, let alone to compare its rate of return to Western Electric's rate of return on capital. Depending upon the goods supplied, a higher rate of return on Bell business might conceivably be justified from time to time and, in any event, simply comparing rates of return in terms of being higher or lower may not be meaningful. Similarly, we cannot judge innovative strength simply by recalling that the transistor and several other truly remarkable inventions have come from the Bell system. Remarkable innovations have also come from non-integrated communications equipment manufacturers such

---

22/ 56 B.T.C. 732 (May, 1966). See also the conclusions on the B.C. Telephone hearings: 56 B.T.C. at 518-21.

23/ 59 R.T.C. 734 (September, 1969).

24/ Regulators have few independent sources of price and cost information for the assessment of the performance of integrated manufacturers. The high rate of new product introduction makes comparison even more hazardous.

as Hughes and Lockheed. The question is whether better performance might not have resulted from a different industry structure. Comparative data are neither available nor possible. The decision must turn on something else.

It is, too, an oversimplification to discuss "equipment manufacturing" without recognizing the different circumstances applying to the research, production and supply of each of the various components. These components include telephone sets and other terminal devices, cable, wire, microwave equipment and switching gear.

Even recognizing that the reasonableness of Northern's costs are at least as significant as its profits, the difficulties of attributing costs are formidable. This difficulty, of course, also applies to rate setting for an enterprise which is engaged in both regulated and unregulated activities. At the 1969 Bell rate hearing there was a lack of hard evidence that unregulated services were not in any degree subsidized by revenues from regulated services. Any such subsidization would permit unreasonably low prices to be charged for the unregulated service, in which event telephone users would pay the subsidy and also, as members of the public, lose by means of the resultant injury to competition in the unregulated activity. The Commission conclusion was "that it would be in the public interest for the Commission to investigate the feasibility of carrying out cost and revenue separations between regulated and unregulated services, and the methods and procedures appropriate for determining such separations; and accordingly, Bell is hereby directed to undertake forthwith a study of such methods and proceedings, and report thereon to the Commission within twelve months"[25].

In its December, 1970 judgment on the most recent Bell application for rate increases, the Canadian Transport Commission expressed concern that in 1968 (the most recent figures available) Northern's rate of return on its Bell business rose above that on its non-Bell business. The Commission warned[26]:

> "... If the reports for 1969 or 1970 reveal a higher rate of return on Bell business than on other, full justification will be required from Bell that it could not purchase part or all of its supplies from other suppliers at cheaper prices than those charged by Northern".

Nor was the Commission impressed with Bell's return on its investment in Northern.

25/ 59 R.T.C. 734 (September, 1969).

26/ Judgment, para. 30(a).

Perhaps a brief discussion of two examples of vertical integration will provide a useful introduction to the examination of the social implications of the fore-and-aft integration of the common carriers in the Canadian context. In the first place, where all production stages are subject to competitive conditions, there is a market test as to the net social benefit derived from vertical integration27/. If there are real economies realized by integration, so that the integrated firm enjoys a cost/product advantage, market forces will compel a change in corporate structure. There are a number of potential sources of economies of integration: engineering economies resulting from integrated systems, continuous flow production and so on; economies achieved by improved and increased communications between purchaser and suppliers, thereby reducing expenses associated with the marketing of products; economies due to the elimination of risk and uncertainty about the availability of supplies and prices; economies in the execution of research and development activities due to the freer exchange of information. If such economies are significant in fact, then social welfare is increased when integration occurs and the cost savings are passed on to consumers.

Fritz Machlup and M. Taber have argued that in the opposite situation where natural monopolies stand in a vertical relationship with one another, and other things are equal, it is more efficient to place the different stages under common control and then regulate so that the behaviour of the complex is compatible with the social interest28/. Insofar as it is true that nice, neat markets exist (i.e. low cross elasticities of supply/demand), then a strong case can be made for integration.

The situation involving integration of a telecommunications carrier backward into the equipment manufacturing industry and forward into the computer processing industry stands somewhere in between the two rather simple cases described above. A number of complications must be taken into account in the telecommunications case:

> "By combining under single ownership the control of development, manufacturing and distribution of, as well as complete control of virtually the entire market for, telephone equipment used in the United States, the defendants have fixed the types, quantities and prices of telephone purchases and sales and have controlled the plant investments and operating expenses on the basis of which federal and state regulatory authorities must fix rates to be charged subscribers for both local and long distance telephone service. The absence of

---

27/ This statement is not strictly true, but it is not seriously misleading in this context. See literature on welfare economics for qualifications.

28/ "Bilateral Monopoly, Successive Monopoly and Vertical Integration", Economica, N.S., V. 27, May, 1960, pp.101-119.

effective competition has tended to defeat effective public regulation of rates charged subscribers for telephone service since the higher the prices charged by Western for telephone apparatus and equipment the higher the plant investment on which the operating companies are entitled to earn a reasonable return. The non-competitive prices of Western's manufactured products have the dual effect of increasing manufacturing profits and of raising telephone operating profits by inflating the rate bases of the Bell operating companies. Both increases accrue to the benefit of AT&T. The difference between the apparent and the real costs of telephone service represents hidden profits which are beyond the reach of public regulation"29/.

A case of possible relevance to the Canadian situation was fought out some years ago in the United States. It has been conveniently summarized by Phillips as follows30/:

"On January 14, 1949, the government filed a civil antitrust suit against AT&T and Western Electric, charging that the companies had engaged in a continuing conspiracy to monopolize the manufacture, distribution, and sale of telephones, telephone apparatus, and equipment, in violation of sections 1 and 2 of the Sherman Antitrust Act. The government asked that: (a) Western Electric be separated from AT&T and dissolved into three competing manufacturing companies; (b) Western Electric be required to sell its 50% stock interest in Bell Labs; (c) AT&T, Western Electric, and Bell Labs license their patents to all applicants on a non-discriminatory and reasonable-royalty basis; and (d) the Bell operating companies be required to buy all equipment and supplies under competitive bidding.

...

Seven years later, on January 24, 1956, the suit was settled by a consent decree. AT&T and Western Electric were required to grant licenses to anyone under all existing and future patents. Virtually all patents issued prior to the date of the decree were to be licensed royalty-free; patents issued subsequent to the date of the judgment were to be licensed at reasonable royalties. The defendants were not required, however, to grant any patent license unless the licensee grants to the Bell System licenses it wants for use in its regulated

---

29/ United States vs Western Electric Company, Incorporated, and American Telephone and Telegraph Company, Complaint filed January 14, 1949. Statement by the Attorney General.

30/ Phillips, The Economics of Regulation (rev'd ed., 1969), pp.671-73.

communications business, subject to reasonable royalties. Western Electric was precluded from manufacturing and selling equipment not of a type sold to the telephone operating companies of the Bell System, except for manufacturing equipment or providing services for the government. Western Electric also was required to maintain cost accounting methods consistent with generally accepted accounting principles and to disclose its manufacturing costs. Finally, AT&T and its operating companies were enjoined from engaging in any business other than furnishing common carrier communications services and incidental operations (such as the directory advertising business)."

The decree has not been uniformly welcomed[31]. Some feel that not only does the AT&T-Western tie induce further backward integration by other telephone companies, but that the consent decree specifically does two unfortunate things: it insulates Western from competition and prevents Western from being a potential competitor in related electronics markets.

Either the situation in the telephone industry can be left as it is, or the vertical relationships can be dissolved, or a regulatory body can seek to preserve the benefits of vertical integration while at the same time attempting to induce or preserve the advantages of competition in the equipment industry.

Many, though not all, carrier arguments against dissolution are predicated on short-term economies resulting from the existing manufacturing industry structure. As such, they largely beg the issue of whether a changed industry structure is in the long range social interest. But dissolution of any historic tie would be a wrench to the industry, and would be neither simple (especially in the case of research laboratories) nor obviously effective with respect to competition in equipment supply. The Rostow Task Force, due to only limited evidence one way or the other and to time constraints, left the question of dissolution open. It did, however, in the American context say that "the question of dissolution aside, we favour access by outside suppliers to the widest extent feasible... We believe that public policy, and enlightened company policy, should seriously explore every possibility of enlarging opportunites for competitive access to the market for communications equipment, beyond the present level of outside market procurement by the carrier affiliates"[32]. However, in the Canadian context a vertical relationship may

---

31/ Note, for example, the conclusion of Irwin and McKee, "Vertical Integration and the Communications Equipment Industry : Alternatives for Public Policy", (1968) 53 Cornell L. Rev. 446, at 457: "It is our view that if the equipment market were opened to effective competition, the innovative process would be greatly encouraged, and ultimately consumers would reap the benefits of cheaper and better services".

32/ Final Report of the President's Task Force on Communications Policy, (Washington, 1968), Chapter 6, p.41.

be important to the development of a manufacturing enterprise of sufficient size to undertake R&D, to be efficient in the production of domestic requirements, and to be competitive in world trade.

So far as changes within the existing North American industry structure are concerned, none of the choices is perfect and most are hampered by an inability to identify and evaluate costs. Few seem interested in following the recent decision of the California Public Utilities Commission to limit the earnings of the affiliated manufacturer supplier to the level set for the utility[33]/. A requirement of competitive bidding, without more, would accomplish little because it would be very difficult to enforce and would usually favour the affiliated manufacturer in any event, due to the persisting advantages of scale[34]/. It is possible, however for a regulatory agency to take a more active role in the area of procurement policy and the availability of research, in order to improve performance in the equipment industry.

Forward integration by the telecommunications carriers into the computer utility field could well aggravate further the existing problems of backward vertical integration. Companies hoping for an easing of foreign attachment tariffs, or companies in the terminal equipment business, would be understandably concerned about the possible expansion of existing captive markets[35]/. If there are

---

33/ Manufacturers do compete, at least in some respects, in a dynamic and unregulated market. The non-regulated manufacturers, domestic and foreign, might gain an undue advantage over a regulated manufacturer in domestic or foreign markets.

34/ It has been suggested that even if the equipment market were 'competitive', carriers would still seek such assurance of supplier credibility (design capability, reliability concerning specifications, delivery schedules and long-range availability) as to disqualify most small or new firms: Borchardt, Structure and Performance of the U.S. Communications Industry (Harvard University, 1970), p.109.

35/ Decisions on the foreign attachment and interconnection issues involve consideration of some difficult questions. What should be the limit of the 'natural monopoly'? At what point does competition in marginal or fringe sectors threaten the carriers' overall responsibility for co-ordination and effective operation of the system? Much of the equipment purchased by carriers consists of attachments used by customers of the utility which could have been purchased and installed by the users themselves. Under what circumstances would the social good be advanced by permitting user purchasing? Borchardt, op. cit., p.107 points out, "For example, the attachment of customer-owned hardware in the case of residential telephone service poses questions of equipment maintenance quite different from those presented in the case of private communications systems, operated by larger business concerns".

economies of integration and if there are important economies of scale in the manufacture of some types of equipment, then, superficially at least, arms length dealing between telephone companies and their integrated manufacturers might be a feasible solution.

In Canada, if both the telephone carriers and the telegraph carriers are permitted to integrate forward, they will rival each other for straight data transmission business and for shared time data processing business. The computer manufacturers will also become a force in segments of the market. Relationships among firms in telecommunications will be complicated indeed. In the case of Bell Canada, for example, major computer manufacturers would at the same time be sellers to Bell (and to some possible extent rivals of Northern), customers of Bell (for leased wires and transmission) and rivals of Bell (as computer utilities). The basic oligopolistic nature of the market plus the impact of these complex buyer/seller links would constitute a complex regulatory problem.

The general questions arising from vertical integration by a regulated monopoly, mentioned earlier, apply also in the case of forward integration. However, in the case of computer services there is an important difference in perspective - sovereignty issues and the need to ensure east-west communications play a larger role. In the telecommunications equipment market Canada has at least one long established company, domestically owned, which probably is sufficiently large and diversified to reap all significant economies of scale in production and R&D. The computer services industry, however, is new and growing rapidly. Capital requirements are large and getting larger, and computer systems are less favourably received on the Canadian stock market then they once were. Some large American corporations are leasing lines and integrating Canadian operations into North American computer systems with the raw computer power and data banks located in the United States. Analysts predict that the computer service industry will not long continue as a highly competitive sector with easy entry and exit and many competitive small firms, that a "shakeout" is inevitable, and that advantages of large size will become increasingly important.

C. Horizontal Integration

Horizontal integration between competitors or potential competitors, while generally easier to analyze than either vertical or conglomerate integration, nevertheless still requires an investigation into the particular facts of each case to determine whether it is desirable or undesirable. This is because horizontal integration can result in economies of scale in production or distribution. It can also, however, eliminate or anaesthetize competition.

In the context of the telephone industry a slightly different risk is present. As a seller Bell is for most purposes a monopolist, but as a buyer it is an oligopsonist. In other words, while absorption of local telephone monopolies does not injure competition in the transmission business, it may well affect competition in equipment manufacture and supply. This is particularly true where a vertical tie exists36/.

As acknowledged above, however, the growth of video, data and private wire needs makes it decreasingly valid to talk of "telephone" or "telegraph" rather than at least "transmission" as the industry in which telephone companies participate. Should microwave and satellite transmission be reserved for the existing common carriers because of the rising degree of interchangeability, or cross-elasticity of demand/supply, between the modes? Are there peculiar economies in common ownership and control? Is common ownership essential for the preservation of the principle of cross-subsidization between telecommunications services and if so, is that principle worth preserving or might some other subsidy technique be preferable? What are the political implications of common ownership and what would be the effect on innovation37/?

Diversity has been an important principle underlying U.S. decisions in these matters. It was manifested in 1913 when AT&T was induced to divest itself of its recently acquired interest in Western Union. It underlay the "Above 890 Decision" by the FCC in 1959 whereby

---

36/ This problem is currently being litigated in the United States in a suit brought by ITT against GT&E as a result of the latter's acquisition of the Hawaiian Telephone Company, a former equipment customer of ITT.

The Act incorporating Bell, as amended, gives the Company the "power" to manufacture telephones and equipment related to telephone systems. It also gives "power and authority" to purchase connecting telephone lines. Either of these powers can be exercised by purchasing shares of companies engaged in those businesses. The Act specifically denies power to hold a license either to broadcast or to operate a commercial CATV service.

37/ See Levin, "Broadcast Structure, Technology, and the ABC-ITT Merger Decision", (1969) 34 Law and Contemp. Prob. 452.

all significant barriers were removed to the installation and operation of private microwave systems using frequencies above 890 Mc.[38]. It has been an important principle behind decisions on domestic satellite systems in the United States. Technical compatibility can be ensured without common ownership.

Diversity of ownership has subjected carrier-operated services, such as private line and teletypewriter message service, to competition. In response to the "Above 890 Decision" in the United States, the Bell System introduced TELEPAK, WATS and WADS for volume users. Western Union introduced Telex.

The common carriers' main argument against diversity in the ownership of transmission facilities is that private unregulated operations only enter the lucrative markets, and that this "cream-skimming" strikes at the root of cross-subsidization between services, a principle which has been almost implicit in the concept of a public utility.

But it should not necessarily follow from a decision favouring a minimum standard of telecommunications service and rates that the less economic services (e.g. rural or Northern areas) be subsidized by the more independently viable ones. An alternative would be a subsidy from another source. The twin questions of (1) whether a subsidy is appropriate, and (2) where it should come from, are separate political issues. "Cream-skimming" telecommunications services, therefore, need not raise the price of telephone service in submarginal areas.

38/ The FCC policy is quite different from the interim policy on microwave relays according to which, pending completion of current studies, the Department of Communications issues licenses: See House of Commons Debates, February 12, 1970, p.3503-04. Under the interim policy the Department goes beyond technical criteria to economic aspects of the public interest. It seeks to foster orderly growth and avoid wasteful duplication of investment.

D. Trade Practices

Carrier practices relating to foreign attachments, interconnection, line sharing or pricing in competitive services, while strictly aspects of behaviour rather than industry structure, nevertheless cannot be divorced from the general question about the proper limits of monopoly power[39/].

In the case of foreign attachments (interfaces, buffers, input and output equipment), carriers have argued that to protect the integrity of the public system users should buy or lease attachments only from the carrier. Signals entering the switched network must not impair the quality of service to other users. In the United States this type of tariff, however, was declared unjust and unreasonably discriminatory by the FCC in the Carterfone decision in 1968[40/]. That case arose from attempts by Carter Electronics Corporation to market an acoustic coupler (a "Carterfone") which linked private mobile radio systems to the public telephone network. The carriers warned Carter customers that they would not be permitted to use the coupler, whereupon Carter filed an antitrust suit for treble damages against AT&T and GT&E. The court referred the issue of the tariff to the FCC, where the Department of Justice intervened against the carriers on the ground of anti-competitiveness of the tariff[41/]. The FCC was unanimous in striking down the foreign attachment prohibition, holding that the carriers should instead establish technical specifications for attachments such as were necessary to preserve the public system from injury.

From the point of view of competition policy, foreign attachment tariffs present the risk of an anti-competitive tying practice whereby market power of the tying product is extended regardless of the intrinsic value of the tied product. The Carterfone decision will help stimulate competition in the equipment industry; particularly, as time-sharing increases, in the case of computer system peripherals. It will also facilitate the growth of the data processing industry. Subsequent to the Carterfone decision the member companies of the TCTS relaxed their foreign attachment tariffs somewhat.

39/ Anti-competitive behaviour in the communications industry is not, of course, limited to the carriers or monopoly power. See R. v. Northern Electric Co. et al, (1955) 3 D.L.R. 449, and Report of the Director of Investigation and Research, Combines Investigation Act, for the year ended March 31, 1966, pp.52-53. However, the abuse of monopoly power presents special issues.

40/ FCC Docket No. 16942 and 17073.

41/ An analogy exists in the case of patents. Anti-combines law in Canada, and antitrust in the United States, prohibits extension of the patent monopoly by the use of restrictive ties in license agreements.

In connection with the computer service industry, carrier control over line-sharing presents issues similar to those of foreign attachments. The viability of small data processing enterprises may well depend upon ability to share the cost of a line.

The same issues also arise when one asks whether private systems should be allowed to interconnect with the public switched network. In a sense interconnection presents more acute issues than the others because the carriers also compete for private system business. The problem could arise in the case of data processing, local loops for long distance private microwave, systems for communication within and between educational institutions, and even systems connecting different premises of the same enterprise.

In 1968, the following provision was placed in the statute creating Bell Canada and describing its powers:

> "For the protection of the subscribers of the Company and of the public, any equipment, apparatus, line, circuit or device not provided by the company shall only be attached to, connected or interconnected with, or used in connection with the facilities of the Company in conformity with such reasonable requirements as may be prescribed by the Company"[42/].

The Canadian Transport Commission has jurisdiction over the issue of "reasonableness".

A related risk, that of predatory pricing by carriers where they offer competitive services, is exemplified by an inquiry conducted by the Combines Investigation Branch[43/]:

> " In December 1957 a complaint was received from a number of firms engaged in installing intercommunication systems to the effect that a large public utility firm, also engaged in installing such systems, was charging unduly low rates therefor. This aspect of the Utility's business was not subject to the Board of Transport Commissioners. It was alleged that the Utility's intercommunication business was thereby subsidized by its public utility business for the purpose of stifling and eliminating competition from smaller competitors.

42/ S.C. 1967-68, c. 48, s. 6.

43/ Report of the Director of Investigation and Research for the year ended March 31, 1960. p.20.

> The complaint was considered from the standpoint of sections 2 and 32 of the Combines Investigation Act in their relation to monopolization of commerce.
>
> Information was supplied by the complainants and the Utility relating to their methods of costing and quoting upon installations. This information indicated that for the purpose of quoting on an installation the Utility applied unit costs derived from its general experience. While this practice might yield higher or lower results than if an installation were individually costed, and in the latter event put competitors at a disadvantage, it appeared nevertheless to be a normal business practice, and the evidence did not establish that such rates were unreasonably low or subsidized by the public utility business. During the currency of the inquiry the Utility introduced a revised system of costing which, while it retained the averaging principle, tended to level out the disparities. The real cause of the complainant's difficulties appeared to stem, rather, from differences in financial stature; the Utility was able to offer its system on a rental basis, which was an attraction to customers, and which the smaller competitors were not, apparently, in a position to do."

A similar issue arose in connection with introduction of the Bell System's TELPAK service in the United States[44]. All these situations require examination of a variety of discriminatory possibilities (e.g. circuit sharing, preferences concerning peak load conditions, back-up services, maintenance) as well as cost allocations.

The terms of intercorporate agreements between telecommunications companies may have implications for subscribers and suppliers, and hence also for regulatory bodies responsible for the public interest. This would be the case in which financial settlements between companies resulted in a transfer of revenues between regions or provinces which happen to coincide with areas served by participating companies. The fiscal implications of such transfers would be of interest to both provincial and federal taxing authorities.

44/ Irwin and McKee, "Vertical Integration and the Communication Equipment Industry : Alternatives for Public Policy (1968) 53 Cornell L. Rev. 446, 455-56.

At the same time, certain technical standards which might be the subject of intercorporate agreements could affect competition in equipment manufacturing. Horizontal co-operation between local or regional telephone monopolies is highly desirable with respect to their activities as sellers of services. As buyers of equipment, however, their co-operation should not extend to restrictive agreements on purchasing policy or unnecessary technical standardization. The same applies to technical standards for horizontal co-operation as sellers. (These suggestions are not to deny the need for extensive technical standardization, especially in the case of planned national systems; they are intended only to record possible implications for competition and innovation and to stress the need for public supervision of decisions on standardization.)

Many feel that if vertical corporate ties in the telecommunications industry are relaxed, certain types of long term requirements contracts will naturally develop to meet business needs, with a similar economic effect. The experience of the prairie telephone companies tends to confirm this view.

IV. PROTECTING THE PUBLIC INTEREST

A. Securing Satisfactory Performance

> "Deciding between the market and the hearing examiner as alternative routes to an optimal allocation of the resources invested by society in its communications needs is one of the most important dimensions of the work ahead of us"45/.

The fundamental requirement, of course, is to decide, as specifically as possible, what is desired in terms of long range performance goals from the national telecommunications industry. Basic Canadian political and economic policy tends to rely upon the free functioning of the market to achieve desirable performance results46/. In situations where the market does not perform satisfactorily a degree of direct government intervention is justified. After functions and jurisdiction have been carefully and precisely defined for regulatory decision a regulatory structure can then be designed, in terms of institutions and the expertise of personnel.

An underlying premise of anti-combines law is that competitive markets perform better, in terms of the economic goals of society as a whole, than non-competitive markets. In seeking to ensure the existence of competitive markets, that law tends to look to industry structure (concentration, ease of entry, etc.) and behaviour (agreements, predatory activities, etc.), rather than to performance (prices, profits, use of capacity, responsiveness to demand, etc.). The existence of market rivalry is the prime interest47/. There is no concept of, or test for, a "fair", "reasonable", "just" or "exorbitant" price; such non-market judgments are irrelevant as either a test for liability or an excuse for the company. At least in theory, competition is more democratic from the consumer's point of view than direct government regulation.

For historical and economic reasons, Canadians do not seem to have the political fear of either absolute size or government control that is evident in the United States. However, certain political dangers of centralized control may obtain in the communications and information services.

45/ Nicholas Johnson, "Harnessing Revolution: The Role of Regulation and Competition in the Communications Industries of To-morrow", (1968) 13 Antitrust Bulletin 881, 882-83.

46/ See Interim Report on Competition Policy (Economic Council of Council, 1969), Chapters 2, 7 and 8; Turner, "The Scope of Antitrust and Other Regulatory Policies", (1969) 82 Harvard L. Rev. 1207.

47/ In an economy of imperfect markets, the law must frequently in particular cases draw a balance between undesirable market power and desirable efficiency. This is especially true of a small economy such as Canada's.

At the present time, the Combines Investigation Act applies largely to articles of commerce. Messages or data are probably not "articles of commerce" within the Act, and accordingly telecommunications is generally regarded as one of the many services not covered. The Act does, of course, apply to the manufacture of physical equipment, but that provides only a very limited capacity to influence broad development in telecommunications[48].

A more permanent limitation upon competition policy is that it can only accommodate goals, values and preferences capable of being expressed in terms of effective market demand. Competition will not, alone, provide a wide range of high quality telecommunications services to all Canadians at a reasonable price. "Discrimination" to an economist, for example, means something different than "discrimination" in a human rights sense or to a political theorist.

In some cases, too, competitive conditions simply cannot be attained, let alone at a tolerable cost. At the same time, however, it may in some circumstances be difficult to judge whether greater efficiency lies in one optimally sized firm, regulated or unregualted, or in two workably competitive sub-optimal firms.

The benefits of direct regulation of industry structure and performance lie in the accommodation of political values that cannot be achieved in the market place. These include the provision of uneconomic services and the technical compatibility of systems.

There are, however, many costs and risks in regulation which Canadians should seek to avoid or minimize. First, so far as economic analysis can determine, regulation often dampens pressures for innovation and, by concentrating on profit or rate of return, impairs efficiency by removing incentives for cost reduction. Second, insofar as innovation costs money and involves risk, control over rates almost invariably influences the resources allocable to research and development or, alternatively, the ability to finance it by means of debt or equity. Third, delay, or what public utility economists call "regulatory lag", can interfere with quick response to technological change or public demand. Also, past experience offers certain lessons, or at least exposes problems, for institutional design:

> "(Governments) have seldom placed first-rate men on commissions. They have seldom appropriated the funds necessary to build up dedicated and technically competent staffs. Regulatory commissions, state or federal, are usually floated into existence on a wave of sentiment for the control of certain economic abuses. At the start, the commission stands a good chance of

---

48/ The Economic Council, in its Interim Report on Competition Policy, recommended that service industries come within the scope of the Act. Amendments, following study of that Report, will soon be introduced in Parliament.

drawing able people ready to slay the dragon of abuse, and sustains enough public support to be able to withstand the political counter-pressure of the industry which has been brought under regulation. This condition seldom lasts long. The general public is likely to feel that, once the commission is established, the problem of economic performance is under control, whether or not the facts warrant this faith. The Commission's activity falls more into routine paths. In its work, day by day, it hears continuously the point of view of the business firms it seeks to regulate. Eventually, and without any outright bribery or favoritism, the industry viewpoint sounds more and more reasonable, and the regulatory commission may depart from its original role as guardian of the public interest and shape its policies in line with the interest of the regulated firms."49/

Several suggestions for alleviating these disadvantages have been offered from time to time. It is, for example, becoming trite to stress the general need for new regulatory techniques to accommodate technological change and to encourage as much dynamism as possible in regulated activities. More specifically, most observers stress the desirability of relying on competitive forces wherever possible, and for building incentives into the regulations50/.

Adjustment to inevitable technological change gives rise to important difficulties:

"Price, output, and investment decisions which may appear "rational" or "optimum" in one technological context may be quite unacceptable and anachronistic in another"51/.

Also, of course, technological change may either erode or supply the basis for the very decision about whether or not to regulate. It may dictate either greater or less concentration of ownership. Basic questions of control should accordingly be open to review at any time.

49/ Caves, American Industry : Structure, Conduct, Performance (Prentice-Hall, 1964), pp. 69-70.

50/ See Wein, "Fair Rate of Return and Incentives - Some General Considerations", in H.M. Trebing, ed., Performance Under Regulation (1968), p.39, and the comments by Conrad and Hughes at pp. 68 and 73 respectively. See also Beigie, "Selected Policy Issues in Canadian Telecommunications" (paper presented to the meeting of the Canadian Economics Association, June 3, 1970).

51/ Adams and Dirlam, "Market Structure, Regulation, and Dynamic Change", in Trebing, ed., Performance Under Regulation (1968), pp. 131 and 138.

There are many degrees between utility regulation in the fullest sense (rates, tariffs, entry, merger, supervision of accounts, extension or abandonment of service) and free competition. Different media require different solutions. Newspapers, for example, are subject to free competition, as are broadcasters except for entry. Entry into the broadcasting indutry is dependent on license partly because of the need for orderly use of the radio spectrum. But competition and regulation can work together and apply to different aspects of the same enterprise. Indeed, the need for certain regulatory authorizations provides new possibilities for anti-combines sanctions.

Borchardt points to a risk involved in mixing control policies[52/]:

> "... by distributing functions for the sake of injecting elements of competition, a risk is run of shifting the focus subtly from acceptable performance of a very large and complex multipurpose system over extended periods of time to the performance of parts of such a system with regard to some single purpose over relatively short time spans. Instead of asking how tasks and opportunities should be distributed between companies in such a way that such companies will have adequate long-range potentials and incentives for contributing to the continuing development of the multipurpose intercommunication system, we seek to ascertain whether at any given point in time a particular class of customers receives the desired quality of some particular service at the lowest possible cost. This was the basic issue on which the FCC majority and minority split in the Microwave Communications case."

However, there seems no reason why proper appreciation of these and similar risks will not help minimize the danger.

The existence of some uncertainties, resulting from a lack of information, often creates the need to work from presumptions in selecting appropriate controls. Many economists, for example, argue that the burden of proof should lie on those who support any amount of regulation, let alone regulation of a dynamic, high technology industry, to prove the need for regulation in every aspect[53/]. Many support a similar presumption

---

52/ Borchardt, Structure and Performance of the U.S. Communications Industry (1970), pp. 95-96.

53/ In this connection, the phrase "computer utility" is unfortunate insofar as it suggests an answer to the question of the appropriate degree of government regulation, if any.

against vertical integration in those types of industries, saying that companies seeking to integrate vertically should be required to establish the existence of significant economies. It would not be inconsistent to switch the presumption in the case of an established, vertically integrated enterprise.

B. Co-ordination of Authority

After the public has assumed certain decision-making functions in the area of performance the procedures for making these decisions become critical[54/]. An important aspect of this procedure, resulting from the relevance of competition policy, is the mechanics for utilizing the expertise and perspective of the Department of Consumer and Corporate Affairs.

It is important that legislation clearly define authority and jurisdiction to decide on the application of competition policy to the industries and particular activities being regulated[55/]. Should a decision of the regulatory body exempt an activity from the dictates of the Combines Investigation Act? The clearest example of a problem is, perhaps, a proposed merger within the regulated sector, but competition policy is also relevant to such things as rate structures, cross-subsidization, technical standardization and entry.

In view of the fact that many regulated enterprises also participate in unregulated activities, and that technological developments lead to shifting boundaries of product or service markets, co-ordination between regulatory authorities and the administrators of anti-combines and patent policy is imperative. That co-ordination might, depending on the nature of the problem, take the form of a right to intervene in regulatory proceedings[56/], formal consultation, or the need to secure clearance from the Department of Consumer and Corporate Affairs.

54/ See Interim Report on Competition Policy (Economic Council of Canada, 1969), pp. 162-71.

55/ One of the issues raised in the Supreme Court of Canada in the case of Re Couture et al (November, 1969) was whether the CRTC had jurisdiction to formulate and implement its own policy of competition, specifically with respect to cable TV systems. The Court upheld the CRTC's jurisdiction in the particular case, but it's view on the above issue was not made clear.

56/ Interventions by the U.S. Department of Justice before the FCC were influential in both the Carterfone decision and the decision on the proposed ABC-ITT merger.

APPENDIX A

Financial and Ownership Data of Canadian Telephone Companies

Source: Financial Post Survey of Industrials (1969)

NOTE:
1 - current assets
2 - fixed assets
3 - total assets
4 - shareholders' equity
5 - operating revenue
6 - net income

Bell Canada: 1968

	($000)	
1	174,895	
2	2,435,593	After depreciation of 843,631,000
3	2,862,524	
4	1,414,152	
5	758,478	
6	114,329	

Subsidiaries: Northern Electric Co. Ltd.;
Telecommunications de l'Est Ltee;
Telebec Inc.;
The Capital Telephone Co. (99.9% owned);
The North American Telegraph Co. Ltd. (wholly-owned);
La Tuque Telephone Co. (99.9% owned);
The New Brunswick Telephone Co. (50.4% owned);
Northern Telephone Co. (95% owned);
The Avalon Telephone Co. Ltd. (99.6% owned);
Telecommunications Richelieu Ltd. (99.9% owned);
Southern Teleservices Ltd. (99.6%);
Telephone Princeville Ltee (94.8%).

Other Interests: Maritime Telegraph and Telephone Co. Ltd. (5.9% preferred and 52.4% of common shares o/s. No voting control).

The New Brunswick Telephone Company Limited: 1968

	($000)	
1	8,659	
2	111,202	After depreciation of 35,260,000
3	120,880	
4	55,887	
5	31,965	
6	4,332	

Northern Telephone Limited: 1968
In January 1969 company sold assets of its Western Division (including Algoma Central Telephone Co. Ltd.) to Bell Canada for approxi. $6 million.

Subsidiary: Northern Quebec Telephone Inc. (wholly-owned). Formed in 1967 to consolidate all operations in Quebec.

	($000)	
1	3,697	
2	37,417	After depreciation of 16,135,000
3	45,720	
4	20,676	
5	10,808)	consolidated
6	1,118)	

Avalon Telephone Company Limited: 1968

	($000)	
1	2,735	
2	43,282	After depreciation of 7,112,000
3	48,550	
4	20,549	
5	11,676	
6	1,366	

Maritime Telegraph & Telephone Company Limited: 1968

	($000)	
1	8,238	
2	120,986	After depreciation of 38,490,000
3	131,719	
4	64,461	
5	35,208	
6	5,428	

Subsidiaries: The Island Telephone Co. Ltd. (54.6% owned); Cable Vision Services (N.S.) Ltd. (wholly-owned); formed to construct coaxial cable system in N.S.

Anglo-Canadian Telephone Co. Ltd.: 1968

	($000)	(Que. '34) holding company.
1	40,182	
2	625,433	After depreciation of 155,903,000
3	673,125	
4	283,665	
5	170,043)	consolidated
6	10,109)	

Subsidiaries: Own telephone systems in B.C., Quebec and the Dominion Republic and supervise publication of telephone directories and installation of services for telephone companies in Canada. General Telephone & Electronics Corp. owns all o/s common shares.

Subsidiaries: Canadian Telephone & Supplies Ltd.;
Dominion Directory Co. Ltd.;
Compania Dominicana de Telephonos;
Corp. A, York Investment Co. Ltd.

Controlled: British Columbia Telephone Co. (50.24% of o/s ord. shs.);
Quebec-Telephone (55% interest).

Chilliwack Telephones Ltd. (see B.C. Tel. and Anglo-Can.)

Assets purchased by B.C. Tel. Co. August 1, 1954 for $679,000.

Community Telephone Co. Ltd.

Company placed in liquidation in 1969. Taken over by Continental Telephone Corp.

British Columbia Telephone Co. (see Anglo-Can.) 1968

With subsidiaries, company operating more than 90% of telephones in B.C. and 914,304 telephones serviced Dec. 3, 1968. Also operates wireless telephones and radio-telephone systems. Controlling interest is held by the Anglo-Canadian Telephone Co.

Subsidiary: Okanagan Telephone Co. (99.6% owned).

	($000)	
1	27,440	
2	483,209	After depreciation of 133,396,000
3	518,215	
4	213,607	
5	139,389)	consolidated
6	16,915)	

Abitibi Telephone Inc.

Northern Telephone Ltd. which held majority interest acquired remaining interest early in 1968.

Dominion Telegraph Securities Ltd.

Charter surrendered June, 1949, telegraph system and lease sold to CNR.

North West Telephone Co.

Merged with B.C. Telephone Co., January 1961.

Quebec Telephone (see Anglo-Can.) 1968

Subsidiaries: The Bonaventure & Gaspe Telephone Co. Ltd. (wholly-owned). Serves south shore of Gaspe Quebec Communications Inc. (wholly-owned) incorporated July, 1968 to operate coaxial cable system and transmit commercial and educational television.

	($000)	
1	5,535	
2	97,403	After depreciation of 16,970,000 in 1968.
3	103,598	
4	29,087	
5	22,632)	consolidated
6	2,579)	

Okanagan Telephone Co. (see B.C. Tel. Co.)

As at December 31, 1968 had 46,424 telephones in operation.

	($000)	
1	1,618	
2	17,745	After depreciation of 5,752,000
3	19,583	
4	6,257	
5	4,996	
6	460	

The Aylmer & Malahide Telephone Co. Ltd.: 1968

Conducts general telephone business cables in south-western Ontario. Has some 5,600 telephones in use.

	($000)	
1	138	
2	1,121	After depreciation of 553,000
3	1,313	
4	354	
5	432	
6	37	

The Island Telephone Co. Ltd.: 1967 (see MT&T)

	($000)	
1	539	
2	10,936	After depreciation of 3,517,000
3	11,565	
4	6,259	
5	2,967	
6	411	

The Caradoc Ekfrid Telephone Co. Ltd.

Head office Melbourne, Ontario. Operates telephone system in a number of townships in south-western Ontario.

Kootenay Telephone Co. Ltd.

Wound up. Assets purchased by B.C. Telephone Co. in 1953.

APPENDIX B

CANADIAN CORPORATE RELATIONSHIPS OF BELL CANADA
(Subject to revision in respect of subsequent acquisitions)

Bell Canada
95.4% c.s. held in Canada, Dec. 31/69

Bell Canada - Northern Electric Research Ltd. 1970. Bell 51% Northern 49%.

Newfoundland Telephone Co. Ltd.,[1] - 99.7% owned. Subsidiary, acquired in 1962.

The New Brunswick Telephone Co. Ltd.,[1] controlled 50.5% c.s. Purchase offer in 1966. Formerly held 35% c.s.

Lievre Valley Tel. Co., 100% owned,[1] acquired 1969.
The Capital Tel. Co. Ltd.,[1] wholly-owned

Maitland Teleservices Ltd., 96.3% owned, acquired 1969.
La Cie de Telephone Disraeli,[1] wholly-owned, acquired 1967.

Telebec Ltee,[1] 99.9% owned, formed May, 1969 by amalgamation of -

- La Compagnie de Telephone d'Arthabaska Ltee.
- La Tuque Telephone Co. (acquired 1967)
- The Pontiac Tel. Co. Ltd. (acquired 1968)
- Telebec Inc. (acquired 1966)
- Telecommunications de L'Est Ltee.
- Telecommunications Richelieu Ltee.
- La Telephone de Contrecoeur Ltee. (acquired 1968)
- Telephone Princeville Ltee. (acquired 1968)

Northern Telephone Ltd.,[4] 88.3% owned. In 1964 Bell acquired a minority interest; bought majority interest in 1966.

Telephone du Nord de Quebec Inc., wholly-owned Formed in 1967 to consolidate all operations in Quebec. Took over former subsidiaries including Blais Tel. Inc., Abitibi Tel, Inc., La Sarre Tel. Sue, Northern Quebec Tel. Ltd.

Maritime Telegraph & Telephone Co. Ltd., associated company. Bell holds 5.9% of preferred and 51.8% of c.s. outstanding. (Direct ownership without voting control was acquired in 1966.)

The Island Tel. Co. Ltd.,[4] 54.6% owned
CableVision Services Ltd.,[4] wholly-owned.

North American Telegraph Co., wholly-owned.

Northern Electric Co. Ltd.,[1] wholly-owned.
Subsidiaries

- Dominion Sound Equipments Ltd.
- Northern Electric Telekomunikasyon A.S. Turkey
- Northern Electric Caribbean Ltd.
- Northern Electric Hellas
- Microsystems International Ltd. - formed in 1969 and controlled by N.E. Northern Electric sold its minority interest in General Sound and Theatre Equipment in 1968

---

1. Financial Post Card Reader Service
2. Inter-Corporate Ownership, 1967 (DBS)
3. Standard and Poor's
4. F.P. Survey of Industrials, 1969

APPENDIX C

CANADIAN CORPORATE RELATIONSHIPS OF GENERAL TELEPHONE AND ELECTRONICS INTERNATIONAL INC. (U.S.)

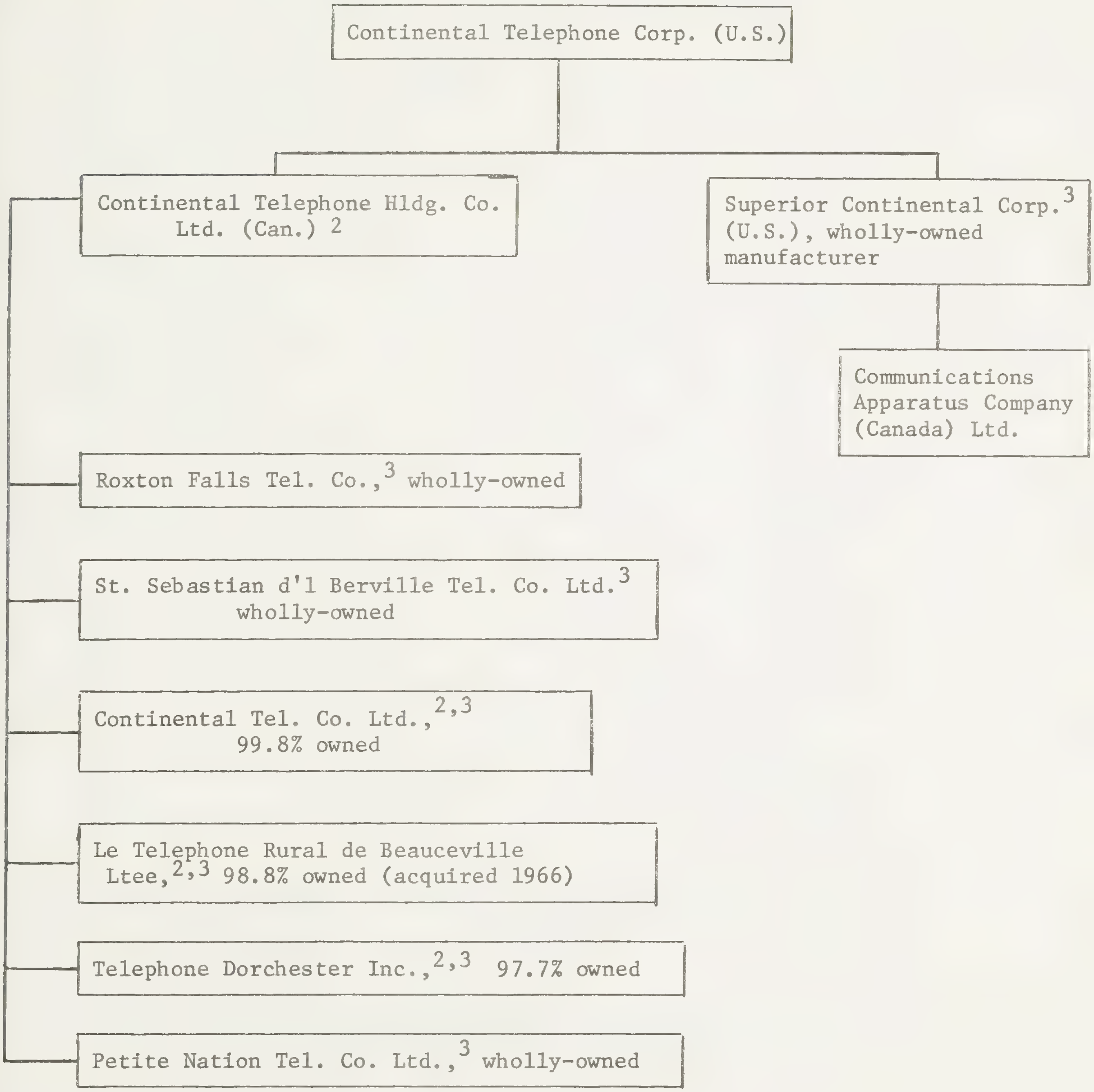
- General Telephone and Electronics International Inc. (U.S.)
  - Automatic Electric (Can.) Ltd.[2,3] 100% owned
    - Lenkurt Electric Co. (Can.) Ltd.[2,3] 100% owned
  - Sylvania Electric (Can.) Ltd.[2] 100% owned
    - Electrolier Corp.[2] 100% owned
    - Freeman W.&Son[2] 100% owned
    - Powerlite Service Ltd.[2] 100% owned
  - Anglo-Canadian Telephone Co.[1] all c.s. held by Gen. Tel. and Electronics Corp. (U.S.). (Gen. Tel. increased holdings in 1965). A holding company.
    - Dominion Directory Co.Ltd.,[1] wholly-owned
    - York Investment Co. Ltd.,[1] wholly-owned, commenced operation April, 1967
    - Compania Dominicana de Telephonos C. por A.,[1] wholly-owned, operates in Dominican Republic
    - Canadian Telephones and Supplies Ltd., wholly-owned,[1] installation and repair service
    - Quebec Telephone,[1] owns 55% of c.s. acquired 1966,
      - Bonaventure and Gaspe Tel. Co. Ltd.,[4] wholly-owned.
      - Quebec Communications Ltd.[4] wholly-owned
    - British Columbia Telephone Co.,[1] owns 50.24% c.s.,
      - Okanagan Telephone Co.,[1] 99.8% owned, to be amalgamated eventually, acquired 1966.

---

1. Financial Post Card Reader Service
2. Inter-Corporate Ownership, 1967 (DBS)
3. Standard and Poor's
4. F.P. Survey of Industrials, 1969

APPENDIX D

CANADIAN CORPORATE RELATIONSHIPS OF CONTINENTAL TELEPHONE CORP. (U.S.)



---

1. Financial Post Card Reader Service
2. Inter-Corporate Ownership, 1967 (DBS)
3. Standard and Poor's
4. F.P. Survey of Industrials, 1969

APPENDIX E

Number of Telephones Operated by Large Telephone Systems and Total All Systems (Canada: 1968)

Company		Total Telephones
Okanagan Tel. Co.		46,424
B.C. Tel. Co.		867,880
Quebec Tel. Co.		120,070
Total	1,034,374	
Bell Canada		5,450,782
Avalon		82,645
The Island Tel.		30,683
Maritime		256,388
New Brunswick		206,507
Northern Quebec		45,516
Northern		49,905
Total	6,122,426	
Manitoba		399,100
Saskatchewan		297,009
Alberta		432,612
Total	1,128,721	
Fort William		26,449
Port Arthur		25,193
Edmonton		190,328
Total	241,970	
Total major companies		8,527,491
Total, Canada		8,818,000

NOTE: CNT provides telephone service in Newfoundland, Northwest Territories, British Columbia and Yukon, which is not covered in above statistics. In 1968, CNT provided a total of 37,200 telephones.

Source: DBS, Telephone Statistics, Preliminary Report on Large Telephone Systems 1968 and DBS Telephone Statistics 1968. Q.P.

APPENDIX F

Market Shares of Major Canadian Telephone Companies in Terms of Number of Telephones (1968)

	%
Bell to total Eastern Provinces	84.0
Bell group to total Eastern Provinces	94.4
Bell to major companies	63.9
Bell to total Canada	61.8
Bell group to major companies	71.8
Bell group to total Canada	69.4
Maritime to total Canada	2.9
Manitoba to total Canada	4.5
Saskatchewan to total Canada	3.4
Alberta to total Canada	4.9
Non (Bell or General Tel. groups) to total Canada	7.4
General Tel. group to total Canada	11.7
British Columbia & Okanagan to total Canada	10.4
Quebec Telephone to total Canada	1.4

NOTE: Bell group includes 7 companies (see Appendix E). General Telephone group includes 3 companies. It is possible that some small companies controlled by Bell have not been included in the Bell group, but are included in statistics for total telephones operated in Canada.

Total telephones in provinces east of Manitoba were 6,486,000 or 73.6% of total telephones in Canada.

Source: DBS, Telephone Statistics, Preliminary Report on Large Telephone Systems 1968, and DBS, Telephone Statistics 1968. Q.P.

APPENDIX G

Selected Statistics from Canada's 300 Largest Companies

Industrial Companies:

Rank 1968	Company	Total Assets 1968 $000,000	Sales, Revenue and/or Income 1968 $000,000
1	Canadian National Railways	4,066	962
2	Bell Canada	2,863	758
3	CPR Company	2,155	562
18	B.C. Telephone Co.	518	139
72	Maritime Tel. & Tel. Co. Ltd.	132	35
89	Quebec Tel.	104	23
147	The Avalon Tel. Co. Ltd.	49	12
155	Northern Tel. Ltd.	46	11
41	Northern Electric	265	426

Source: Canadian Business Magazine (1969)

APPENDIX H

TRANS-CANADA TELEPHONE SYSTEM

1 Nicholas Street, Ottawa, Canada

MEMBER COMPANIES

Alberta Government Telephones

Box 2411, Edmonton, Alberta

Bell Canada

1050 Beaver Hall Hill, Montreal, Quebec

British Columbia Telephone Company

768 Seymour Street, Vancouver 2, B.C.

Manitoba Telephone System

489 Empress Street, Winnipeg 10, Man.

Maritime Telegraph and Telephone Company Limited

Halifax, N.S.

Newfoundland Telephone Company Limited (formerly Avalon)

St. John's, Newfoundland

Saskatchewan Telecommunications

Regina, Saskatchewan

The New Brunswick Telephone Company Limited

22 Prince William Street, Saint John, N.B.

The Canadian Overseas Telecommunication Corporation (Associate Member)

TELECOMMISSION

Study 2(g)

Description of the Canadian Telecommunications Manufacturing Industry

The Department of Communications

TELECOMMISSION

STUDY 2(g)

Description of the Canadian Telecommunications Manufacturing Industry

Available by mail from Information Canada, Ottawa,
and at the following Information Canada bookshops:

HALIFAX
1735 Barrington Street

MONTREAL
1182 St. Catherine Street West

OTTAWA
171 Slater Street

TORONTO
221 Yonge Street

WINNIPEG
393 Portage Avenue

VANCOUVER
657 Granville Street

or through your bookseller

Price: 75 cents Catalogue No.: Co41-1/2G

Price subject to change without notice

Information Canada
Ottawa, 1971

This Report was prepared for the Department of Communications by a project team made up of representatives from various organizations and does not necessarily represent the views of the Department or of the federal Government, and no commitment for future action should be inferred from the recommendations of the participants.

This Report is to be considered as a background working paper and no effort has been made to edit it for uniformity of terminology with other studies.

TERMS OF REFERENCE

To:

a) describe the telecommunication manufacturing industry, its sales, product lines and marketing, and its corporate affiliations;

b) determine the relative importance of the telecommunication sector in the Canadian economy;

c) forecast future expansion of the industry, noting the effect technological change is having on manufacturing practices.

The statistical material in this report has been supplied by the Department of Industry, Trade and Commerce. References to DBS material have been noted in the text.

PROJECT TEAM

D.A. Hilton, Liaison Officer	-	The Department of Communications
G.K. Davidson	-	The Department of Communications
J.R. Mercier	-	The Department of Industry, Trade and Commerce
L. Balcer	-	Electronic Industries Association of Canada
T. Mimee	-	Electronic Industries Association of Canada
C. Hughes	-	Automatic Electric (Canada) Limited

CONTENTS

DESCRIPTION OF THE MANUFACTURING INDUSTRY

I INTRODUCTION

This paper is designed to serve as background material for related Telecommission studies, and by describing the manufacturing segment illustrates its importance and relationship to the communications sector. An expository section is presented first to define the industry, its dimensions, composition and structure. This is followed by more detailed descriptions of products, sales, and other pertinent data. These descriptions have been compiled by the industrial sector. An assessment of the relative importance of the industry in the Canadian economy is made. Lastly a discussion is undertaken on the future of the industry.

II EXPOSITORY REVIEW OF THE INDUSTRY

1. Definition of the Industry - The Telecommunications Manufacturing Industry, for the purposes of this report, has been interpreted as meaning "Manufacturers of equipment employed directly in the telecommunications media". Manufacturers of all basic electronic and electrical components for such equipment, and also for electronic equipment not directly associated with the telecommunications media, have been excluded. It should be recognized however that some of the larger equipment manufacturers make a large percentage of the components they require. The following broad product lines have been included:

- * a. Telephone and Telegraph equipment.
- b. Radio Communications equipment.
- c. Television and Radio Broadcast and Distribution equipment.
- d. Television and Radio Receivers.
- e. Telecommunications Wire and Cable.
- f. Electronic computers and related equipment.

Note: Some published figures on the "Communications Industry" have related to communications services (i.e. operating telephone systems). This paper deals only with production and sales of products by manufacturers.

* This includes switching, transmission and station apparatus for telephone and telegraph and data network and line services.

2. Dimensions of the Industry - The telecommunications industry in Canada produces and sells nearly every kind of device or system which is required for the telecommunications media. In addition, the Industry provides research engineering and system engineering in depth to meet most market requirements. It also provides full installation and maintenance services. Notable exceptions are computer central processors which are not manufactured in Canada. The industry is geographically centered in Ontario, with fair penetration into Quebec and B.C., and scattered facilities in four other provinces. Altogether there are 167 industrial plants. Statistics based upon DBS surveys for 1968 are as follows:

employment - 44,600

payroll - $269 millions

shipments - $600 millions

manufacturing establishments (1967)

New Brunswick	1
Quebec	34
Ontario	112
Manitoba	1
Saskatchewan	1
Alberta	6
British Columbia	12

3. Composition of the Industry - The industry is composed of two large manufacturing organizations, each one integrated with large Canadian carriers; approximately a dozen substantial non-integrated companies; and a variety of small specialist companies. The Electronic Industries Association of Canada is the principal spokesman for the industry. Figure 1 is a sketch showing the corporate structure, and the related product lines for Bell Canada Ltd. and Figure 2 is a similar sketch for General Telephone and Electronics International, parent of the other Canadian "vertical".* The Bell organization is much the larger of the two "verticals". The larger Northern Electric factories are concentrated in Quebec and Ontario at Montreal, Lachine, Belleville, London and Bramalea. There are smaller works in Halifax, Saint John, Toronto, Winnipeg and Calgary. Microsystems International, a newly incorporated subsidiary of Northern Electric, is located at Ottawa. The company also has subsidiary companies in Turkey, Greece and the Caribbean. The General Telephone and Electronics complex has large plants in Brockville, Ontario and Burnaby, B.C. The telecommunications organization of G.T. & E. also has small plants located in Lethbridge,Alberta, Regina, Saskatchewan, and Rimouski,Quebec. Another division of the G.T. & E. organization includes Sylvania Electric of Canada Ltd.

* vertically integrated from production facilities to customer telephone.

FIGURE I

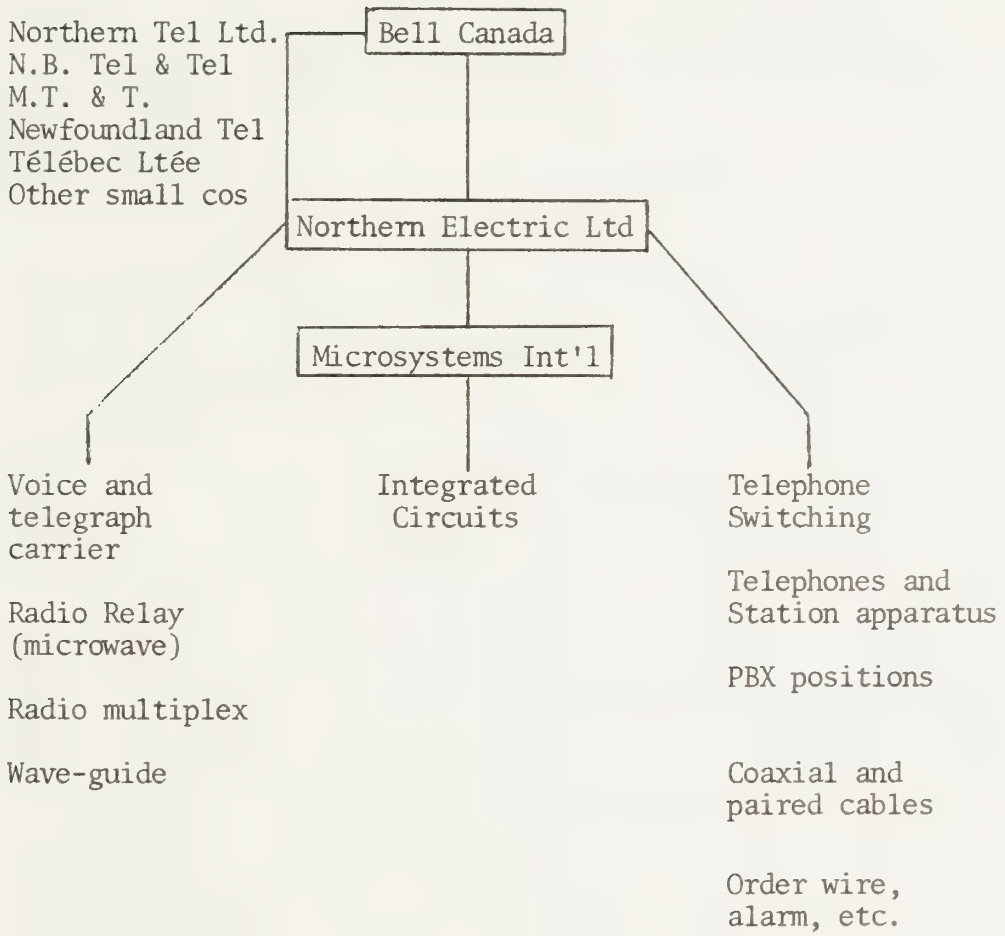
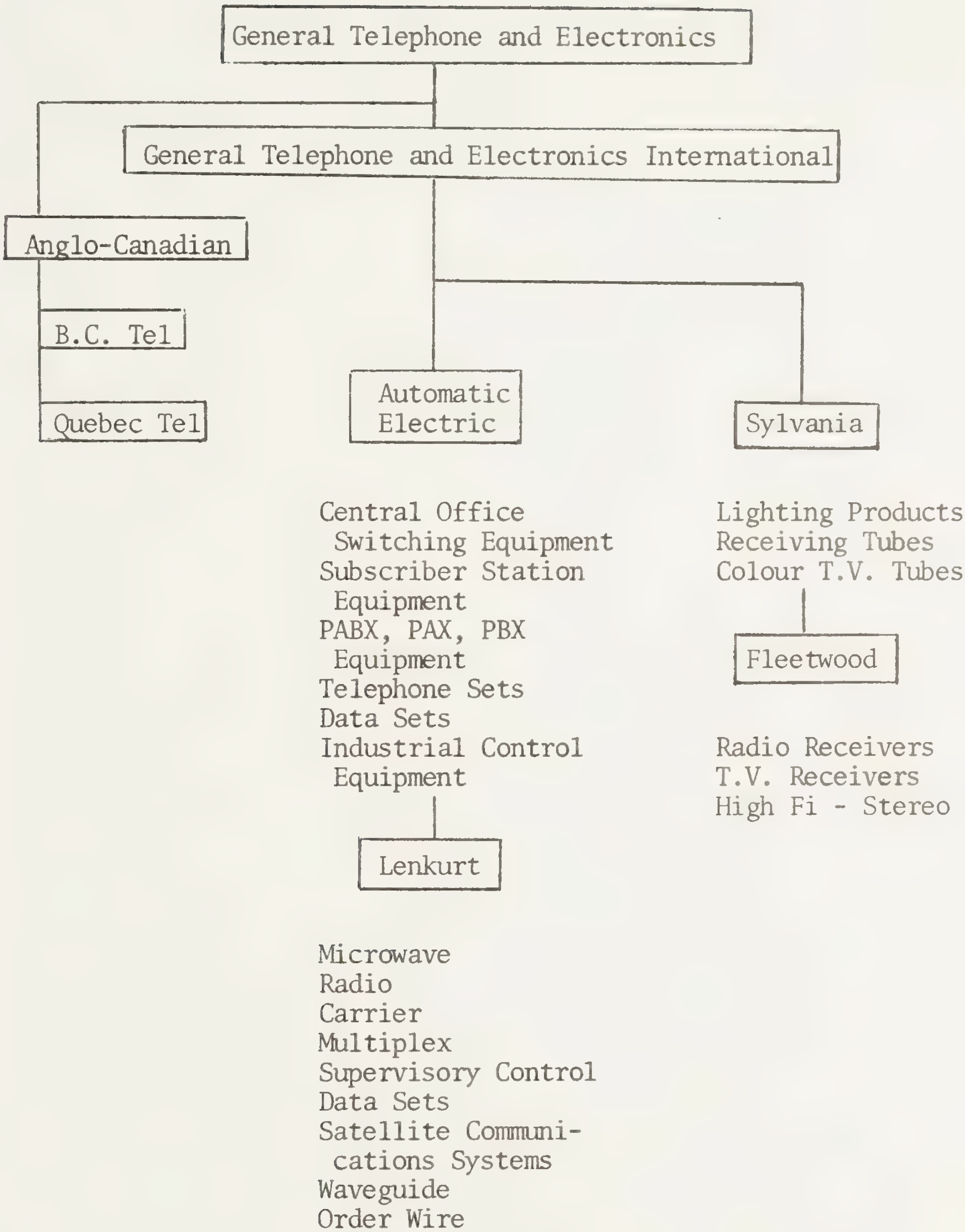

Northern Tel Ltd.
N.B. Tel & Tel
M.T. & T.
Newfoundland Tel
Télébec Ltée
Other small cos
Bell Canada
Northern Electric Ltd
Microsystems Int'l
Voice and telegraph carrier
Radio Relay (microwave)
Radio multiplex
Wave-guide
Integrated Circuits
Telephone Switching
Telephones and Station apparatus
PBX positions
Coaxial and paired cables
Order wire, alarm, etc.

FIGURE 2


General Telephone and Electronics
General Telephone and Electronics International
Anglo-Canadian
B.C. Tel
Quebec Tel
Automatic Electric
Sylvania
Central Office Switching Equipment
Subscriber Station Equipment
PABX, PAX, PBX Equipment
Telephone Sets
Data Sets
Industrial Control Equipment
Lighting Products
Receiving Tubes
Colour T.V. Tubes
Fleetwood
Radio Receivers
T.V. Receivers
High Fi - Stereo
Lenkurt
Microwave
Radio
Carrier
Multiplex
Supervisory Control
Data Sets
Satellite Communi- cations Systems
Waveguide
Order Wire

with its main plant located in Drummondville, Quebec and a subsidiary plant in Cornwall, Ontario. Another subsidiary of Sylvania is Fleetwood, located in Montreal.

These organizations dominate the manufacture, sale and installation, of telephone, telegraph and switching equipment as well as of cables. They do a substantial proportion of their own research, development, and product design but at times do purchase manufacturing rights to make products of others. The trend is towards greater self sufficiency in designs.

The larger non-integrated companies including RCA Ltd., Collins Radio Ltd., CGE, Canadian Westinghouse, Canadian Marconi, Philips Electronics Industries, Canada Wire and Cable, typically operate divisions which are concerned with manufacture and sale of telecommunications equipment, but most of these companies also have other major interests. The non-integrated companies, particularly those which are U.S. owned, may manufacture products which have been designed by the parent organization. A growing trend where there is U.S. control, is for the U.S. parent to assign products for global production in Canada, frequently on a short term basis. Some of these companies have corporate responsibility for design, development, and international marketing of complete product lines.

The integrated and the larger non-integrated companies are accustomed to supplying systems to specification, and have the necessary depth in their organizations to assume full responsibility from contract award to customer acceptance.*

The small businesses in telecommunications manufacturing tend to be Canadian owned and to be engaged with specialties, for example, Central Dynamics and McCurdy Radio Industries Ltd., produce audio and video studio equipment and Spilsbury and Tindall Sales Ltd. produce certain types of radio communications equipment. These companies generally create their own designs.

On the other hand the industry is well supported by small firms engaged in specialty manufacturing processes. There are firms in Canada with superior skills in the manufacture of printed circuit boards; in silk-screen processes, in fabrication of illuminated panels and in sophisticated welding, soldering, and brazing techniques. Of considerable significance also is an active group of producers of sheet metal products such as chassis, cabinets and consoles. Latterly too, the development of satellite systems, and particularly the demand for earth stations outside of Canada has brought the Canadian construction industry into the sphere of support for the telecommunications industry. Thus we find that Dominion Bridge offers a facility for the design, fabrication, assembly and

* commonly described as "Turn-Key" contracting

installation of large earth station antenna structures. Canada Iron Works also is engaged in the fabrication and assembly of large antennas on a sub-contract basis for a Texas based U.S. firm. Canada has therefore a capability to supply world markets in this highly sophisticated field and this must be recognized as a plus measure of the depth of the Canadian industry.

The Bell Canada system including Northern Electric is Canadian owned. Northern Electric has control of its subsidiaries. With the exception of some of the smaller specialties companies the rest of the industry is affiliated to foreign companies, the majority of them being located in the U.S. (Table 1. Page 47)

4. Marketing in the Industry

4.1. General - The Canadian non-consumer product telecommunications market has developed two characteristics. On the one hand there is a continuing requirement for voice frequency and telegraphy equipment which can be supplied by imports, or by manufacturing in Canada to designs imported from the U.S. or the Continent. On the other hand there is a demand, arising from the Canadian environment, for equipment with innovative features designed to cope with local geographical, climatic and operational problems. This has led to Canadian designs for HF, VHF radio telephony equipment and for microwave relay equipment. Such products, developed in Canada, to meet Canadian technical requirements, have found acceptance by foreign nations which have similar problems, and which lack the capability to create their own products. There has been a pattern established for U.S. firms to rely upon their Canadian subsidiaries to supply their needs for certain foreign markets which can be served by equipment designed and produced in Canada.

In the development of telephone networks, however, various world regions have come under the influence of specific design and service philosophies. The European countries banded together early within the ITU Study Groups, and their suppliers produced similar designs. The North American region integrated with the leadership of the Bell System which also saw great

advantages in a one system approach. Other developing regions have tended to be influenced by the international suppliers to the European networks. Consequently, telecommunication products, especially switching systems, designed for North American use, require substantial redesign for offshore use (and vice versa).

4.2. Domestic Marketing - The major suppliers of telecommunications products operate without intermediary distributors, and deal directly with the end users. This is because much of the business involves systems technology. The marketing process involves preparation of technical proposals in response to customer specifications, supplemented by schedules and plans for delivery and installation of components of the system, together with an overall quotation. A single system, from the time of a customer inquiry, until the date of customer acceptance of the finished installation will span a period of one to three years. Servicing such a market is a highly technical process and requires engineering and logistic support as well as a manufacturing capability.

Marketing practices for radio and television broadcast equipment generally fall under the category of systems technology as discussed above. Supply of computers and peripherals requires marketing techniques that are systems oriented.

The consumer product market is really three quite different markets as far as supply is concerned. The major market is television, about one-third of all T.V. sets being imported complete, mostly from Japan and the U.S.A.

Radio spans two markets, the major portion (in units) is in portable and small home radios (about three per home) and over 88 per cent of these are imported complete (almost

entirely from the Far East). The other part of the market is for console combination radio and record players, most of which are designed and manufactured in Canada. The style and quality of these products are building a steady export market to the U.S.A.

The automobile radio market is largely influenced by the automobile makers, as about 80 per cent of new cars are sold with radio installed. These are in two cases made by subsidiaries of the automobile makers, from largely U.S. designs. But a substantial quantity of radios is designed and manufactured in Canada. Many units are exported to the U.S.A. either directly, or included in cars exported under the Auto Pact.

In summarizing then, we have seen that the Canadian domestic market has innovative and non-innovative requirements and that the former are being met by Canadian designed and produced equipment. The market is also broadly divided into systems, and consumer products. And finally we note that the major manufacturers of the "verticals" service the system-oriented section of the market and dominate that portion of the industry.

4.3. Foreign Marketing - The general pattern of our exports of telecom capital equipment is shown in Table II on page 50.

Telephone equipment (microwave, multiplex, exchanges, outside and inside plant, subscriber equipment and other peripherals) accounts for nearly two thirds of our exports.

Our sales to the USA are about 60 per cent of the total. This is in part due to the production sharing program and production orders placed by USA parents on their Canadian subsidiaries, often for shipment to a third country. Sales of telephone equipment are higher to the U.S. due partly to Canadian products being suitable for U.S. application with virtually no re-design. An undetermined proportion of exports to the other regions shown is a result of parent marketing and shipments from the Canadian facilities. One may thus conclude that our dependence on USA orders is somewhat higher than the 60 per cent shown above.

Northern Electric is by far the largest and most active Canadian controlled company in export activities. It has made important market penetrations in many areas of the world, based upon its own design effort and its own sales effort. Many of the other Canadian owned companies lack the necessary capital to develop complete systems for foreign customers.

Of the foreign subsidiaries, export marketing practices vary. While Lenkurt and Automatic Electric and Canadian Marconi actively pursue exports sales opportunities, few of the remainder have foreign marketing sales offices in Canada for non-military lines. Many of the major telecommunications manufacturers have some proprietary product lines which they promote with their own Canadian marketing staffs in foreign markets.

Table II indicates that there is a developing export market for radio communications equipment. The exports rose from a low figure in 1962 to a level of almost $19 million in 1968, indicating an acceptance of Canadian communications technology and abilities for start of successful international marketing. The majority of exports in radio communications is shared by Northern Electric, RCA Limited, Canadian Marconi Company, Lenkurt Electric of Canada and Collins Radio of Canada. Over the past few years, satellite earth stations have arisen as a major item of potential export of communications equipment.

For a number of companies which are subsidiaries export opportunities are limited by the parent's global marketing strategy. This has had a limiting effect on the export potential of Canadian manufacturers. The maximum support of the Canadian economy by a foreign

subsidiary occurs when there is the greatest degree of product rationalization. This implies that development, production and foreign marketing be done from the Canadian facility.

Smaller Canadian companies are taking advantage of licensing sales agreements with larger foreign firms to significantly develop their export sales.

5. Manufacturing Technology in the Industry - Manufacturing procedures, tooling, and proprietary electronic test equipment in Canadian industry are practically identical to those which will be found in plants of comparable size in the U.S.A. This reflects U.S. world leadership on a price-quality basis in this field. Too, the subsidiaries of U.S. firms have had made available to them, by the parent companies, and at little cost, a large body of technology in the form of manufacturing process specifications, engineering standards, quality control and inspection procedures and practices, and assembly techniques.

Canadian manufacturers nevertheless exert themselves to develop their own techniques to better the productivity indexes of their parents and of competitors. Every production line requires a special mix of proprietary test equipment and machinery together with specially designed jigs, fixtures, test set-ups, wiring harness boards and automated or semi-automated electronic test equipment. In fact at least one Canadian firm pioneered designs for paper tape controlled automatic testing for faults in electronic assemblies, sub-assemblies, wiring harness and cables. Canadian manufacturing ingenuity has found wide scope in this field.

Principal U.S. made production and test equipments which are found in many Canadian plants, include shake

tables, coil winders, hand tools, inspection and test equipment for testing metal parts, shielded screened cages, environmental chambers for humidity, temperature and altitude testing, oscilloscopes, multimeters, signal generators and many others. Also some metal cutting machines, particularly jig borers are imported from Europe as are also a few items of laboratory electronic test equipment. Canadian designed and manufactured wave-soldering machines are a notable exception to this pattern.

The foregoing comments apply principally to the manufacture of non-consumer products where, owing to the specialized user requirements, there are limited production runs and consequently there is a relatively high percentage of labour (including labor requiring manual skills) and also of engineering. Examples are microwave systems, radio multiplex, and switching systems. In this area automation has advanced as far inside Canada as outside.

Consumer products and wire and cable are basically the only products in the industry which can be produced on a scale to permit the capital outlays required for reducing labour content to a minimum.

6. Installation and Maintenance - As we have seen, the "verticals" and the larger non-integrated companies will supply systems on a Turn-Key basis so that in general they are prepared to install the equipment. This activity can include preparation of sites, fabrication of buildings, erection of towers and initial system testing. The operating groups of common carriers in Canada are well organized and well equipped to perform the maintenance required after formal site acceptance of the equipment.

These comments do not of course apply to consumer products. In this field installation is performed by small service companies. Warranty is limited to short term parts replacement. With the advent of colour television, the additional complexities of the sets over "black and white" designs, has created new problems. Service organizations lack the additional test equipment and personnel training. This has resulted in the introduction or at least the expansion of factory supported maintenance.

7. <u>Industry Position in the Canadian Economy</u> - It is important to keep in mind that the electronics industry which provides services to all other industries, is the base upon which the next stage of our industrial and cultural development will grow. The telecommunications industry which is the largest part of the electronics industry is becoming vital to the health and growth of all other industries and to the economy in general through the services it provides. The pace of modern Canadian business is directly related to the advancement of telecommunications technology and the expansion of the services offered by the telecommunications media. The strength of the industry compared to other industries cannot be found in statistics. For example, DBS 61-005 August 1969 shows that the industry provides slightly less than 1.0 per cent of the Real Domestic Product. However, it also shows the telecommunications industry to be in the top three with regard to growth rate of its output. The impact of the industry upon the economy must be considered to carry with it a multiplying factor relating to its catalytic action on the Canadian economy.

III DESCRIPTION OF THE INDUSTRY BY SECTORS

1. Basis for Classification and Description - Two categories, "A", "B", are defined. "A" is that part of the manufacturing industry which is most apt to be directly affected by telecommunication policy. "B" category groups manufacturing establishments whose products, while not usually directly affected by telecommunications policy, are heavily influenced by such policy as a result of direct relationships with the primary category products.

A Category: Telephone and Telegraph
Radio Communications
Radio and Television Broadcast and Distribution Equipment

B Category: Radio and Television Receivers
Telecommunications Wire and Cable
Electronic Computers and Peripherals

Descriptions of equipment types within these categories and groups closely follow the breakdown used in the Industry Commodity Classification now being considered by the Dominion Bureau of Statistics (DBS). Sources for the names of manufacturers listed as representative have been extracted from DBS annual census of manufacturers, the Electronic Industries Association of Canada (EIAC) and the Department of Industry, Trade and Commerce.

Industry statistics available through DBS publications are rarely in the specific format required for this type of analysis and figures quoted herein result from re-groupings of DBS figures modified by IT & C figures in some instances.

2. Telephone and Telegraph Equipment Sector - includes telephone sets, switchboards, private branch exchanges, teleprinters, line amplifiers, jack fields, central office switching equipment, regenerative repeaters, fault location equipment, broadcast routing equipment, multiplex and carrier equipment for open wire, cable, radio and power lines.

Employment: 18,200

YEAR	FACTORY SHIPMENTS ($ MILLIONS)	IMPORTS ($ MILLIONS)	EXPORTS ($ MILLIONS)
1961	87.8	16.3	4.5
1962	103.1	27.7	5.9
1963	117.4	24.1	8.8
1964	127.0	24.7	10.9
1965	135.2	25.0	14.3
1966	186.4	30.2	10.9
1967	252.5	36.0	18.9
1968		32.1	48.5

Companies: Manufacturing activity, in this sector is undertaken principally but not exclusively by the following companies:

a) Dominant companies: Northern Electric Company Limited and Automatic Electric Ltd. Together these firms account for more than 70 per cent of the current sector manufacturing activity. Although Automatic Electric - Lenkurt manufacturing activities far exceed those of the firms listed under b), its activities are considerably less important than those of Northern Electric.

b) Other firms: AEI Telecommunications (Canada) Ltd., Brown Boveri (Canada) Ltd., Collins Radio Company of Canada Ltd., Farinon Electric of Canada Ltd., ITT (Canada) Ltd., Northern Radio Manufacturing Co. Ltd., and Radio Engineering Products Ltd., Philips Electronics Industries Ltd.

Sector Features:

- Extensive dominance of manufacturing activity by member companies of the "verticals".
- Dominant firms responsible for very great percentage of export activity.
- Telegraph equipment sector is a very minor part of overall sector in factory shipments and exports but practically equal to telephone equipment sector in imports.
- For most firms listed as "other firms" equipment manufactured for this sector represents a relatively minor portion of overall company manufacturing activity.
- Systems engineering capabilities are normally required of manufacturers as most sales are planned, systems engineered, manufactured, installed and tested before "turning over the key" to the customer. The value of this systems engineering, installation and commissioning tests, which sometimes can run as high as 20 per cent - 30 per cent of manufactured equipment sales, is not included in the sector statistics.

3. Radio Communications Equipment Sector - Includes point-to-point, line of sight, scatter, Very Low Frequency (VLF), Low Frequency (LF), High Frequency (HF), Very High Frequency (VHF), Ultra High Frequency (UHF), microwave, portable, transportable, vehicular, space borne (satellites), air borne, ship borne radio communication transmitting and receiving equipment for commercial and military uses; earth stations; communications antenna; control and telemetering equipment.

Employment: 5,200

YEAR	FACTORY SHIPMENTS ($ MILLIONS)	IMPORTS ($ MILLIONS)	EXPORTS ($ MILLIONS)
1961	27.6	12.3	N.A.
1962	28.7	11.9	N.A.
1963	37.7	12.6	2.0
1964	27.7	9.8	4.1
1965	32.0	10.0	5.0
1966	36.8	15.6	6.6
1967	37.6	23.0	12.9*
1968		24.0	18.9*

Companies: Manufacturing activity, as defined above is undertaken principally but not exclusively by the following companies:

a) Dominant companies: Canadian Marconi Company, Collins Radio Co. of Canada Ltd., Lenkurt Electric of Canada Ltd., Northern Electric Co. Ltd., RCA Ltd., Canadian General Electric Company Ltd. and Canadian Motorola Electronics Ltd. Together, these firms are responsible for 70 per cent of the current sector manufacturing activity.

* Certain manufacturers export under DBS Export Category 634-99. It was impossible to make the appropriate extracts to supplement these numbers.

b) Other firms: Andrew Antenna Co. Ltd., Farinon Electric of Canada Ltd., ITT Canada Ltd., Raytheon Canada Ltd., TMC (Canada) Ltd., Philips Electronic Industries Ltd., Pye Electronics Ltd., International Systcoms, and at least 10 other firms active in manufacturing some of the sector's products, but as a minor portion of their overall activity.

Sector Features:

- Again, systems engineering capabilities are required of manufacturers in the microwave line of sight and earth station activity areas. These activities dominate this manufacturing sector but systems engineering plus installation and testing costs between 5 and 30 per cent of equipment manufacturing sales are not reflected in the statistical description.
- Land mobile equipment manufacturing is comparable in size to the foregoing activity but DBS figures do not permit a quantitative breakout.
- In order of decreasing amounts of manufacturing activity the following sub-sectors are also identifiable -

    airborne HF, VHF and UHF equipment;
    HF, VHF and UHF land and marine radio equipment
    communications antenna equipment
    control and telemetering equipment
    other radio communication equipment as defined under "Equipment Manufactured".

- The degree of export activity closely follows that of manufacturing activity.

4. Television and Radio Broadcast and Distribution

Equipment - Includes AM, FM and TV Broadcasting transmitters and distribution equipment; audio and video studio equipment; CATV and CCTV equipment (other than monitors, wire and cable), including educational television equipment.

Employment: 1200

YEAR	FACTORY SHIPMENTS ($ MILLIONS)	IMPORTS ($ MILLIONS)	EXPORTS ($ MILLIONS)
1961	8.3	2.1	N.A.
1962	5.4	4.2	N.A.
1963	5.2	5.1	N.A.
1964	7.3	5.5	N.A.
1965	10.4	7.5	1.0
1966	15.8	18.8	2.0
1967	10.9	14.2	3.8
1968		13.4	5.8

Companies: Manufacturing activity as defined above is undertaken principally but not exclusively by the following firms:

a) Dominant firms: Canadian General Electric Co. Ltd. and RCA Ltd., together with Central Dynamics Limited and Cascade Electronics Ltd. and McCurdy Radio Industries Limited these firms are responsible for better than 70 per cent of current manufacturing activity.

b) Other firms: Benco Television Associates Ltd., Collins Radio Co. of Canada Ltd., Richmond Hill Laboratories, General Instrument of Canada Ltd.

Sector Features:

- Manufacturing activity is sporadic and highly dependent on Canadian Radio-Television Commission approval of broadcasting licenses.

- Technology, with the minor exceptions of a few Canadian firms, is largely imported from the U.S. through parent-subsidiary relationships and the adoption of U.S. standards.
- Approximately 80 per cent imports and exports are from and to the U.S.

5. Television and Radio Receivers, Domestic - Includes AM, FM multiband, domestic portable and car radio broadcast receivers; television receivers; combinations of radio and television receivers.

Employment: 7,000

YEAR	FACTORY SHIPMENTS ($ MILLIONS)	IMPORTS ($ MILLIONS)	EXPORTS ($ MILLIONS)
1961	85.1	16.9	2.0
1962	107.4	15.5	3.3
1963	111.7	14.6	6.3
1964	128.6	18.2	7.7
1965	132.4	24.0	8.3
1966	162.8	36.5	20.3
1967	165.4	49.4	24.0
1968		59.5	29.6

Companies: Manufacturing activity, as defined above is undertaken principally although not exclusively by the following companies: Canadian Admiral Corporation Ltd., Canadian General Electric, Canadian Westinghouse Co. Ltd., Clairtone Sound Corporation Ltd., Fleetwood Corporation Ltd., Philco-Ford (Canada) Ltd., Philips Electronics Industrial Ltd., RCA Limited, Electrohome Limited, Canadian Motorola Electronics Ltd.

Sector Features

- Unlike previously discussed sectors, there exists no overall dominance by a small group of firms.
- There has been a rapid growth in imports from the United States and Japan; especially in television receivers with small screens.

- Export gains are attributable, almost exclusively, to car radio specialization as a result of the Auto-Pact. Exports of television sets have been decreasing for the past three years.

6. Telecommunications Wire and Cable - Includes manufacturers of exchange, toll and entrance telephone cables; switchboard wires, drop wires and other telephone wire; television and radio wire and cable; annunciator and office wire and cable; signal and control cables.

Employment: 3000

YEAR	FACTORY SHIPMENTS ($ MILLIONS)	IMPORTS ($ MILLIONS)	EXPORTS ($ MILLIONS)
1961	46.1	2.9	2.5
1962	48.9	1.9	2.6
1963	52.0	2.2	3.2
1964	63.2	3.0	6.7
1965	79.1	3.0	8.2
1966	93.6	4.9	8.8
1967	86.1	5.5	8.6
1968	93.7	4.9	9.0

Companies: Manufacturing activity, as defined above is undertaken principally, although not exclusively, by the following companies:

a) Dominant companies: Canada Wire and Cable Company Ltd. (Noranda Mines), Northern Electric Co. Ltd. (Bell Canada) and Phillips Cables Ltd. These firms are responsible for well over 70 per cent of current sector manufacturing activity. The manufacturing activity at Canada Wire and Cable and at Phillips Cables Ltd. far exceeds that maintained in the firms listed under "other firms" but is considerably below that maintained at Northern Electric.

b) Other firms: Andrew Antenna Co. Ltd., Canadian General Electric Co. Ltd., Fabricon Manufacturing Ltd., General Wire and Cable Ltd., ITT (Canada) Ltd., Pirelli Cables Ltd.

Sector Features

- The statements made with reference to Northern Electric's predominance in manufacturing activity can also be extended to research, development and export activities.
- Predominant firm associated with large user i.e. Bell of Canada.
- Recently, a substantial number of firms have pooled their resources through acquisitions and/or mergers.
- Availability and price of copper are presently major concerns for this industry.

7. Electronic Computers and Related Equipment - Includes manufacturers of electronic computers and associated peripherals such as punched card and paper tape input/output equipment, magnetic tape and disk storage devices, line printers, key input and display terminals, etc.

Employment: 10,000

YEAR	FACTORY SHIPMENTS ($ MILLIONS)	IMPORTS ($ MILLIONS)	EXPORTS ($ MILLIONS)
1961			
1962			
1963	Not available		
1964			
1965	40.0	56.6	27.1
1966	60.0	105.1	32.9
1967	70.0	126.5	44.9
1968	94.0	121.0	41.4

Companies: Manufacturing activity, as defined above, is undertaken principally but not exclusively by the following companies.

a) Dominant companies: By far the dominant company, accounting for at least 70 per cent of manufacturing activity, is International Business Machines Inc.

b) Other companies: Applicon Computer Systems Ltd., Computing Devices of Canada, Consolidated Computer Services Ltd., Digital Equipment Corporation, Digital Systems Associates, Ferranti-Packard Electric, Honeywell Controls Ltd., I.P. Sharp Ltd., Litton Systems (Canada) Ltd., Canadian Westinghouse Company Limited.

Sector Features

- There is no production of large central processors, and manufacturing activity is primarily directed to the peripheral equipment area. This has been brought about by Canadian industry attempting to keep abreast of technology, by developing and marketing peripheral units which are not available in general from foreign sources. This activity has found a primary market in the U.S.

8. Summary Table

The following table has been extracted from individual tables on the preceeding pages and will serve as a basis for further discussions on export activities.

	1967 Shipments		1967 Exports		Per cent of total exports
	$millions	Per cent of total shipments	$millions	Per cent of shipments	
Primary Categories					
a) Telephone & Telegraph	252.5	40.6	18.9	7.5	16.7
b) Radio Communications	37.6	6.0	12.9	34.3	11.4
c) Radio & TV Broadcast	10.9	1.8	3.8	34.9	3.4
Secondary Categories					
d) Radio & TV Sets	165.4	26.6	24.0	14.5	21.2
e) Telecom. Wire & Cable	86.1	13.8	8.6	10.0	7.6
f) Computers	70.0	11.3	44.9	64.1	39.7
	622.5		113.1		

IV FUTURE EXPANSION OF THE COMMUNICATIONS INDUSTRY

1. The Present Fact - The electronics industry in Canada currently directly employs probably 58,000 people. Of these, 44,600 at least are employed in telecommunications manufacturing. Additionally, there are a large number of installation and service technicians working either with manufacturers, distributors and dealers, or independently to maintain electronic products. Of these, probably at least 6,000 are supporting the telecommunications manufacturing activity.

As has been described, primary telecommunications equipment has certain custom-made characteristics. This means that it is a labour intensive industry, where net output per employee is less than that found in other more highly mechanized industries. In the past five years productivity in telecommunications has risen. Exports are increasing at a greater rate than imports. While there are many reasons for this, increased productivity has to be a basic factor.

The annual increase in capital investment is $30-34 million. According to the EIAC brief of March 1969 the return on investment for the electronic part of the telecommunications industry, after taxes, is as follows:

	1965	1967
Per cent of Sales	3.1%	2.1%
Per cent of Invested Capital	10.8%	7.0%

By modern corporate standards a return of less than 7.0 per cent net on invested capital is not acceptable. Therefore, if the trend shown from 1965-7 continued to 1969 the industry would now be in a very difficult position from which to bid for capital to support expansion programs.

The future of the industry depends upon its capability to expand its facilities and to capture larger markets. Tomorrow's sales depend upon yesterday's R&D expenditures. According to the EIAC brief Canada currently spends about 1.4 per cent of GNP in R&D (or slightly less than half of the U.S. rate).

2. Basic Industry Trends - Statistics quoted in Part III reveal that in the sectors of industry relating to manufacture of telephone, telegraph, and radio communication equipment there has been a dramatic change in the past four years. Exports now approach the magnitude of imports, or exceed them, instead of the reverse. Canadian export products are more and more assuming characteristics suited to world markets. On the other hand, exports of radios and television receivers have fallen off to a negligible level while imports have risen.

The radio communications and radio (microwave) relay groups reflect differing influences. Currently microwave products are off the production peak reached during the fabrication of the main Trans-Canada networks. On the other hand major economic developments in the North centered on oil discoveries; the renewed emphasis in basic mineral exploitation in the Western Provinces, for coking coal and copper production to serve the Pacific rim is stimulating the market for radio communications, and for microwave equipment. Additionally, development of hydro power in more remote parts of Canada is sustaining the demand for microwave systems for control of hydroelectric grids. The extraordinary demand rate for expansion of the telecommunications media - at least 15 per cent per annum - has the effect of flattening the peaks and hollows in the demand curve for equipment.

Procurement by Telesat Canada of its initial earth stations and control centre equipment will introduce some $20 million in contracts awarded during early 1971. It is estimated that an adequate competitive climate can be maintained without resorting to bids on a world-wide basis. It is expected that six to ten Canadian-based companies will compete as prime contractors for the various types of stations in this system and that two to five companies will be successful in securing prime contracts. It is too early yet to assess the effect on the microwave terrestrial systems and therefore on the industry, of satellite routings of message and T.V. traffic.

The "A" category industry is expected to continue to concentrate on telephone and telegraph equipment. Considerable advance work is now under way to prepare for large scale usage of digital techniques in signal transmission. This will affect the manufacture of cables as well as of electronic equipment. For many years, paired telephone cable has been the most important item, in terms of value and volume, supplied by the wire and cable industry. The need for wide band transmission requiring coaxial cable is becoming more and more evident. While electronic devices will probably extend the life of paired cable by increasing its transmission capability, the demand for coaxial cable within 10 or 15 years may well overtake that for paired cable. When this occurs the

wire and cable industry must be prepared to invest in more R&D and new manufacturing facilities.

New large electronic switching systems are now being introduced into the telephone networks and will substantially take over sales from electro-mechanical systems by the end of the 1970's. Expansion of switching markets will continue as system growth, and replacements create demand for supply of new switches.

Terminal equipment for remote accessing of computer facilities and memory banks is seen as a burgeoning market. Canadian industry should make a concentrated effort to enter this field.

A paper produced by the executive of the IEEE in December 1969 is of great interest as it graphically discusses electronics industry trends in the U.S. and points out two major changes. Firstly, the paper notes a significant reduction in Government buying and also of sales of consumer products. Secondly, it notes an increase in sales to industry. These changes may be expected in Canada as well. The development of sales to industry will have far reaching results since telecommunications devices and systems are used largely to increase the efficiency of the industries which they serve. This trend could lead to a different product mix than now exists in the telecommunications industry, and be reflected in the output of the Canadian industry.

3. <u>Prognosis From Industry</u> - Industry spokesmen report that the growth experienced by the industry during the 1960 decade is unlikely to be retained during the 1970's, notwithstanding a continued high rate of growth of the world telecommunications market, without fairly severe adjustments within the industry itself and without further special government incentive assistance in certain segments.

The industry contends that continued health of the industry is predicated in great part upon achieving a deeper penetration in the export field than that attained during the 1960's, particularly in the high growth segments of telephone and telegraph equipment and radio communications equipment. In the face of increasing vigour of competition from Japanese, American and European companies, Canadian industry realizes that such deeper penetration requires exceptional business planning, covering both the innovative cycle attendant with new designs and exploitation of the selected international market areas.

The industry commented favourably upon the improvements in the practices and measures of the integrated government Department of Industry Trade and Commerce, to assist industry in its growth objectives. Spokesmen reported that the unfolding pattern of greater government/industry cooperation and coordination to attain greater exports through R&D, production,

and marketing, provided encouragement and challenge for greater reorientation of the industry towards the international market, notwithstanding the attendant business difficulties.

Industry considers that government-sponsored telecommunication programs, like the Canadian domestic satellite system, project a world image of the importance that Canada attaches to advances in telecommunications technology. Such major advanced domestic programs build industry expertise that greatly enhances the ability to contend in the international field.

4. <u>Expansion of Exports</u> - The development of the Canadian telecommunications industry is affected by the size of the domestic market, and its hope for greatest expansion rate will result from export sales. In addition to helping maintain a strong viable domestic industry, export sales have the additional salutary benefit of aiding the country's balance of payments position.

Canada's future in the field of telecommunication exports will most likely be in the area of large systems where we have proved our competitiveness in a number of international tenders. These systems consist mainly of microwave, multiplex, switching, VHF equipment and cable. Export sales of such equipment are often dependent on the seller having complete systems capability. Another important factor is the increasing tendency of the purchaser, usually a foreign government, or government owned company to insist upon the creation of a subsidiary manufacturing plant to maintain and expand the system it proposes to purchase.

It is shown in Table II* that the exports of telephone and telegraph equipment, although large in terms of total industry exports, represented only 7.5 per cent of total telephone and telegraph shipments in 1967. The very large domestic market of over $250 million, forms a sound base to bring about much greater exploitation of the international market. The 1968 exports of $48.5** million illustrate

** Not tabulated in Table II.

that this growth potential is beginning to be realized in part. As previously described, telephone and telegraph equipment manufacture is dominated in Canada by Northern Electric and Automatic Electric, both vertically integrated companies. Northern Electric, with its additional strength as a prime Canadian supplier of wire and cable, is in a favourable position to give stronger contention in the international market against foreign vertically integrated companies. Potential markets in this and other areas are illustrated in Table II on page 50.

In the sector for radio communications, the exports rose from zero in 1962 to a level of almost $19 million in 1968, indicating an acceptance of Canadian communications technology and ability to start successful international marketing. The majority of exports in radio communications has been in the field of microwave radio systems, often performed on a turn-key basis. This segment of radio communications exports is shared by Northern Electric, RCA Limited, Lenkurt Electric of Canada and Collins Radio of Canada. In the past two years, satellite earth stations have arisen as an item of major export potential.

Two major conditions for higher exports of telecommunications equipment are a reasonable domestic base,

which Canada has, and a forward research and development program aimed at higher performance, lower costs and faster production cycle. The fast growing evolution towards digital communications will require a large development investment in order for the industry to hold and improve its position in the international market. Other conditions for higher exports of telecommunications equipment are greatly improved marketing methods and practices, and greater degree of vertical integration such that an entire foreign telecommunications project can be carried out on a turn-key basis directly by the industry. The marketing expense is predicted to grow, at least by more than 30 per cent in order to compete effectively with American and European telecommunication companies. The prognosis is that larger and fewer companies in the world will handle the majority of world sales of telecommunications equipment.

Acquisitions, grouping and pooling arrangements, including consortia bidding or business mergers, all within government sanctions, and preferably with government influence and/or encouragement, would appear necessary in order to enable the industry to offer a complete integrated "package" of telephone and telegraph equipment and radio communications equipment. Limiting effective consolidation is the possibility of conflict of interest between parent and subsidiary firms operating in a multi-national strategy.

Without an appropriate degree of such consolidation of the industry for these two product lines, the non-integrated companies will face strong competition from new industries in the developing nations (e.g. Israel) and the eastern block countries (e.g. Czechoslovakia, Yugoslavia); and the two Canadian vertically integrated companies might well be unable to attain adequate strength in the broader product front for a required degree of market penetration ahead of American and European competition. Such industry consolidation has, and is, taking place in the United States and Europe. Canadian industry has a unique opportunity for strengthening in this regard, by using developed Canadian capabilities before there is any further capture by American and European enterprise.

Expanded exports of radio and TV sets has limited potential, largely because most foreign countries have, or will initiate, domestic production. Supply of kits has been appreciable and could well be increased again, often as a part of a complete telecommunication turn-key package.

TABLE 1 - OWNERSHIP

COMPANY	CANADIAN	FOREIGN
A.E.I. Telecommunications (Canada) Ltd.		X
Ainslie Antenna Co. Ltd.	X	
Andrew Antenna Co. Ltd.		X
Applicon	X	
Automatic Electric (Canada) Ltd.		X
Beaconing Optical Precision	X	
Benco Television Associates Ltd.		X
Boston Insulated Wire and Cable		X
Brown Boveri (Canada) Ltd.		X
Burroughs Mfg.		X
Canada Wire and Cable	X	
Canadian Admiral Corporation		X
Canadian Bridge Division of Hawker Industries Ltd.		X
Canadian General Electric		
Canadian Marconi Company		X
Canadian Motorola Electronics Ltd.		X
Canadian Westinghouse		X
Cascade Electronics Limited	X	
Central Dynamics Ltd.	X	
Clairtone Sound Corporation	X	
Collins Radio Co. of Canada, Ltd.		X
Computing Devices of Canada Limited		X

TABLE I (Cont'd)

COMPANY	CANADIAN	FOREIGN
Digital Systems Associates	X	
Digital Equipment Corporation		X
Electrohome	X	
ESE Limited	X	
Farinon Electric of Canada Ltd.		X
Ferranti-Packard Electric Limited		X
Fleetwood Corp.		X
General Instrument of Canada Ltd.		X
Heron Cable Industries	X	
Hermes		X
Honeywell		X
IBM Canada Ltd.		X
International Systcoms	X	
I.P. Sharp	X	
ITT Canada Limited Communications Division		X
KA-ME-CO Automation Electronics Ltd.	X	
Leigh Instruments Ltd.	X	
Lenkurt Electric Co. of Canada, Ltd.		X
Marsland Engineering Limited	X	
McCurdy Radio Industries Ltd.	X	
Mond Electronics	X	
Northern Electric Co. Ltd.	X	
Northern Radio Mfg. Co. Ltd.		X
Philco-Ford of Canada Ltd.		X

TABLE I (Cont'd)

COMPANY	CANADIAN	FOREIGN
Philips Electronics Industries Ltd.		X
Phillips Cables		X
Pye Electronics Ltd.		X
Pirelli Cables		X
Pylon Electronic Development Company Ltd.	X	
Radio Engineering Products Ltd.		X
Raytheon Canada Ltd.		X
RCA Ltd.		X
RACAL (Canada) Ltd.		X
Richmond Hill Laboratories		X
Sea Breeze Products	X	
Sinclair Radio Laboratories Ltd.	X	
Spilsbury and Tindall Sales Ltd.	X	
T-Scan Limited	X	
Topping Electronics	X	
TMC (Canada) Ltd.		X
Universal Wire and Cable	X	
Western Electronic Systems Company Ltd.	X	

TABLE II - MAIN CANADIAN CAPITAL TELECOMMUNICATION EQUIPMENT EXPORTS FOR 1969[1]

AREA	Telephone Equipment 634-19	Telegraph Apparatus 634-29	Radio Transmitting 634-90	Radio & TV Bcstg 634-95	Commercial Communication Eqpm 634-99[2]	TOTAL
1. USA	27,064,000	1,465,000	14,219,000	3,538,000	8,943,000	55,229,000
2. U.K.	57,000	-	74,000	545,000	533,000	1,209,000
3. Western Europe	3,317,000	12,000	1,567,000	472,000	2,434,000	7,802,000
4. Eastern Europe	-	-	18,000	-	4,000	22,000
5. Africa	1,792,000	4,000	122,000	43,000	392,000	2,353,000
6. Middle East	5,028,000	-	116,000	232,000	154,000	5,530,000
7. Asia	6,910,000	15,000	779,000	50,000	911,000	8,665,000
8. Australia, N.Z.	17,000	-	113,000	79,000	69,000	278,000
9. Central & South America & Caribbean	9,188,000	7,000	662,000	503,000	922,000	11,282,000
TOTALS	$53,373,000	$1,503,000	$17,670,000	$5,462,000	$14,362,000	$92,370,000

1. Based on DBS December 1969 catalogue Exports by Commodities, catalogue no. 65-004

2. Includes radio navigation equipment excluding radar, coin operated phonographs, sound detection equipment, tapes, video tape and sound recorders, transmitters, T.V. switching equipment, etc.

TABLE III - ESTIMATED WORLD DEMAND FOR COMMUNICATION EQUIPMENT IN 1968 AND IN 1980 ($MILLION)*

BY TYPE OF EQUIPMENT (IT&C)

Station Apparatus	Year	Total World	U.S.	Canada	Europe	Japan	Developing & Australia	Eastern Europe	China
1. Circuit Switching	68	3,551	1,513	113	1,061	253	307	292	12.5
	80	7,051	2,347	188	2,034	765	950	735	32
2. Subscriber Station		1,192	504	38	364	84	101	97	4
		2,274	736	61	660	272	298	237	10
3. Message Switching		152	50	4	50	16	25	7	.3
		314	85	7	95	52	53	21	1
4. Multiplex FDM		994	427	31	293	71	87	82	3.5
		2,178	736	60	678	243	236	216	9.5
5. Multiplex Digital		585	277	19	180	39	23	45	2
		2,917	1,681	77	619	194	30	303	13
6. Radio Relay		663	316	22	198	33	40	52	2.2
		2,093	829	69	678	128	164	216	9.5
7. Earth Stations		57	15	2	9	3	24	4	.2
		78	32	4	8	2	23	8.6	.4
8. Satellite		30	15	2	9	1	1	2	.1
		132	46	13	46	3	11	13	.6
9. Cables		1,622	697	51	478	115	141	135	5.8
		3,526	1,177	103	1,160	375	350	346	15.2
10. Totals		8,846	3,814	282	2,642	615	749	716	31
		20,563	7,669	582	5,978	2,034	2,115	2,096	91

BIBLIOGRAPHY

DBS 31-203 Manufacturing Industries of Canada

DBS 61-005 Index of Industrial Production, August 1966

DBS 43-206 Communications Equipment Manufacturers

EIA Brief to the Government of Canada, December 1968

EIA Presentation to Cabinet Ministers, March 1969

IEEE Market Trends in the Electronics Industry, December 1969

TELECOMMISSION

Study 2(h)

Re-appraisal of the Present Management of the Radio Spectrum

The Department of Communications

Canadian Radio Technical Planning Board

Telecommission Study 2(h)

Re-appraisal of the Present Management
of the Radio Spectrum

Part 1 of 2

Description of Study

Summary of Recommendations and Conclusions

Industry Comment

Available by mail from Information Canada, Ottawa,
and at the following Information Canada bookshops:

HALIFAX
1735 Barrington Street

MONTREAL
1182 St. Catherine Street West

OTTAWA
171 Slater Street

TORONTO
221 Yonge Street

WINNIPEG
393 Portage Avenue

VANCOUVER
657 Granville Street

or through your bookseller

Price: 75 cents Catalogue No.: Co41-1/2H

Price subject to change without notice

Information Canada
Ottawa, 1971

TABLE OF CONTENTS

Part 2 of this study (700 pages) contains the detail reports of the four task forces which accomplished this work. Copies in limited quantities may be obtained from

Canadian Radio Technical Planning Board
880 Lady Ellen Place
Ottawa Ontario Canada

Price per copy - $40.00 post paid

Individual briefs which make up Part 2 may be available in limited quantities. Please write the C.R.T.P.B. office for price and delivery information.

Telecommission Study 2(h)

1. Introduction

In July 1969 the Canadian Radio Technical Planning Board was invited to undertake the major responsibility for the industry part of Telecommission Study 2(h). In addition to C.R.T.P.B. sponsor members, it was agreed that various non-member organizations would be invited to participate in order to make the study truly representative of the communication industry thinking in Canada.

2. Canadian Radio Technical Planning Board

The C.R.T.P.B. was established in 1944 for the purpose of giving advice and making recommendations to the Government concerning the development and regulation of radio services in Canada. Its function is to represent the interests of users, manufacturers and other organizations directly involved with telecommunications in Canada and to develop studies, investigations, recommendations, standards and specifications relating to radio services as may be required.

The 22 members of the Planning Board are called sponsor members who are generally national non-profit associations of commercial companies both operating and manufacturing, technical societies or other bodies concerned with the technical use of radio systems in Canada. The Board consists of representatives of the sponsor organizations, with a President, Immediate Past President, Vice-Presidents, Executive Committee, General Council, Standing and Ad Hoc Committees and a Secretary-Manager. It maintains an office at 880 Lady Ellen Place, Ottawa, which is open three days per week (Tuesday, Wednesday and Thursday).

Sponsor Members of C.R.T.P.B.

American Radio Relay League (Canadian Division)
Association of Municipal Electrical Utilities of Ontario
Canadian Association of Broadcasters
Canadian Association of Broadcast Consultants
Canadian Association of Chiefs of Police
Canadian Broadcasting Corporation
The Canadian Education Association
The Canadian Electrical Association
Canadian Electrical Manufacturers Association
Canadian Overseas Telecommunication Corporation
Canadian Trucking Association
Dominion Marine Association
Electronic Industries Association of Canada
Engineering Institute of Canada
Institute of Electrical and Electronic Engineers
Canadian Cable Television Association
Ontario Department of Education
Ontario Provincial Police
The Railway Association of Canada
Royal Canadian Mounted Police
The Telephone Association of Canada
Western Canada Telecommunications Council

3. Steering Committee

In September 1969 a Steering Committee under the chairmanship of J.C.R. Punchard, President of C.R.T.P.B., was established. It consisted of representatives of interested C.R.T.P.B. sponsor members and a number of non-member organizations. Terms of reference were formulated by this committee on September 17th in Ottawa and it was decided to circulate a questionnaire to interested parties before determining the manner in which this committee would be organized to carry out this study.

Membership of Committee

J.C.R. Punchard	- Chairman	
G. Bedingham	- C.R.T.P.B. (Committee Chairman)	
G.G. Bleiler	- Canadian Trucking Association	
C.J. Bridgland	- Railway Association of Canada	
R.O. Cahoon	- C.B.C.	
W.A. Caton	- Canadian Association of Broadcasters	
A.P. Davis	- Canadian Electrical Association	
N.B. Eaton	- American Radio Relay League - Canadian Division	
A.T. Foss	- Ontario Provincial Police	
E.H. Hayes	- Engineering Institute of Canada	
T.E. Hervieux	- Telephone Association of Canada	
W.J. Huget	- R.C.M.P.	
G. Long	- Canadian Association of Chiefs of Police	
J.M. McNichol	- Canadian Petroleum Association	*
P.M.M. Norman	- Telesat Canada	*
R.W. Norman	- Airtel Ltd.	*
H.M. Reid	- Electronic Industries Association	
I.M. Saunders	- R.C.M.P.	
F.G. Stiles	- C.R.T.P.B. (Committee Chairman)	
B.R. Tupper	- West Coast Telecommunications Council	
J.C. Wilson	- Telephone Association of Canada	
H.E. Parsons	- Secretary-Manager - C.R.T.P.B.	
V. Lee Chong	- Dept. of Communications	*
G.P. Dunn	- Dept. of Communications	*
J.C. MacIver	- Dept. of Transport	*
B.J. McIntyre	- Dept. of Transport	*
G.H. Stewart	- Dept. of Communications	*
G.J. Taylor	- Dept. of Transport	*
W.J. Wilson	- Dept. of Communications	*

plus mailing to

P.G. Bowers	- Ontario Dept. of Education	
T.C. Cunningham	- Air Canada	*
K.J. Easton	- Canadian Cable Television Association	
R.M. Hay	- Railway Association of Canada	
H.W. Jackson	- Canadian Education Association	
C.A. Morrison	- Air Transport Association	*
N. Redsell	- Association of Municipal Electrical Utilities of Ontario	
G. Warden	- Canadian Pacific Airlines	*
R.W. Wilson	- C.R.T.P.B. (Committee Chairman)	

T.M. Mimee	- Electronic Industries Association
C. Harris	- Electronic Industries Association
R.E. Santo	- C.R.T.P.B. (Committee Chairman)
D.J. Willows	- Canadian Electrical Manufacturers Association
J. Loader	- Canadian Cable Television Association
I. Switzer	- Canadian Cable Television Association
W.E. Evans	- Canadian Cable Television Association
A.W. Perser	- Airtel Ltd. *
L.F. Bresolin	- Canadian Gas Association *
G. English	- West Coast Communications Council
B.W. Cosman	- Telephone Association of Canada
C.R. McFarlane	- Dept. of National Defence *
E.B. Powell	- Dept. of Transport *

* Non Members of C.R.T.P.B.

4. Terms of Reference

(i) to study and record present allocations and methods of allocation of the frequency spectrum to the various radio services with a view to determining conditions of crowding, interference, availability and actual use.

(ii) to study in depth the technical problems concerning the use of the radio spectrum.

(iii) to determine how technological advances may best be applied to increasing the efficient use of the spectrum with due regard to the relationship between equipment costs and performance.

(iv) to determine future needs and priorities for frequency assignments and to make recommendations concerning future apportionment of the spectrum to the various radio services.

(v) to make recommendations concerning methods of spectrum management, possibly on a geographical basis, as an improvement over the older method of spectrum administration.

(vi) to undertake some study of the economic worth of the spectrum to Canadians and of costs involved in particular kinds of services with a view to recommending economic factors to be taken into account in the allocation of bands to services and the assignment of frequencies to stations.

5. Questionnaire

(1) Where are we now with regard to the use of the Radio Frequency Spectrum?

(2) What are the current problems concerning use of the Spectrum?

(3) What will your future needs be for frequency assignments for the various radio services?

(4) What current developments in technology will affect the allocation and use of the Spectrum?

(5) How should new technology be applied to the use of the Spectrum?

(6) What principle should be followed in Spectrum Management to ensure meeting future requirements?

After a review of the questionnaire answers by an ad hoc collating committee on November 12, 1969, a plan was drawn up for carrying out this study under five task forces. This plan was presented to the second meeting of the Steering Committee on November 26, 1969, and was modified to four task forces, as follows:

6. Task Forces

(1) Broadcast Service Task Force -- Chairman, R.E. Santo, C.B.C.

(2) Land, Air, Marine, Mobile and Associated Fixed Services Task Force -- Chairman, G. Bedingham, Canadian Motorola.

(3) Microwave Task Force -- Chairman, R.W. Wilson, Maritime Telegraph and Telephone Company Limited.

(4) Other Services Task Force -- Chairman, E.B. Powell, D.O.T.*

*Mr. Powell was unable to continue as Chairman due to absence from Ottawa on government business. His place was taken by Mr. T.E. Devey of the Department of Communications and more latterly by Mr. G.H. Hauch, representing the Telephone Association of Canada.

The Chairmen of these task forces used the technical representation on the Broadcast, Television, Land Fixed and Mobile, Maritime, and Radio Relay Committees of the C.R.T.P.B. augmented by representatives from many other non-member associations and companies, such as Canadian Gas Association, Canadian Petroleum Association, Air Canada, Department of Transport, Department of Defence, etc. The names of the contributors are shown in the reports of each of the task forces.

The reports of the four task force studies are contained in the accompanying Part II volume. This volume was compiled by the C.R.T.P.B. office, but no attempt was made to edit the reports received from the task force Chairmen. The C.R.T.P.B. in no way claims that these studies are complete or unanimous. The industry believes that the task of re-appraising the management of the frequency spectrum is a long and onerous one and that only a broad brush treatment of this subject could be accomplished within the very short time frame of about 10 months. The industry believes that the Department of Communications should give serious thought to requesting that this particular telecommission study be continued, although at a more relaxed pace, over the next few years.

Due to a misunderstanding the Other Services Task Force confined their deliberations to the frequency bands below 30MHz. In so doing, no consideration was given to radar, navigational aids, diathermy, or industrial processing equipment, most of which operates above 30MHz. This represents a definite gap in the information provided. We believe this steering committee should be asked to set up further ad hoc groups to deal with this.

Because it is not possible to obtain unanimous opinion on many aspects of spectrum management, the four sections prepared by the task forces have been reviewed by the sponsor members of C.R.T.P.B. and all the other contributing organizations. Their final comments and observations on the study are contained within this volume. (Part I)

Summary or Recommendations and Conclusions

Each task force report contains a series of recommendations which are summarized here for convenience. For more detail see particular texts. Part 2 of the C.R.T.P.B. Report.

1. Broadcast Task Force - Summary of Recommendations and Conclusions

(a) Frequency Allocation

The allocation and method of assignment of frequencies for broadcasting services in Canada have followed a planned approach on the national and international levels. Flexibility in allocation engineering criteria in Canada has resulted in more efficient use of VHF television and AM broadcast bands.

(b) Receiver Performance

Improvement in receiver performance is required to accommodate the increase in the number of transmitters and the use of receivers in cable systems. It is recommended that a reduction of the excise tax be made an incentive to offset the increased cost of improved receiver performance.

Increased effort should be made to use existing regulatory powers to reduce or at least control steadily increasing electrical noise levels.

(c) Application of Technological Advances

Spectrum usage would be made more efficient by:

(a) improving "operating" selectivity and intermodulation characteristics of receivers.

(b) use of single sideband in short-wave broadcasting.

(c) use of space satellites to make broadcast service available to remote parts of the country.

(d) introduction of channel searching and digital language techniques in the VHF spectrum.

(e) multiplexing of FM channels and TV sound channels.

(f) development and implementation of improved technical standards for cable TV systems.

(g) use of cable transmission as an alternative for TV broadcasting in urban areas.

(d) Future Apportionment of Spectrum

AM Channels -- Saturation of available channels has nearly been reached in the larger cities. Improved channel availability will require a new approach. See Section (e).

Television -- Under present allocation rules, available VHF and UHF channels vary from 4 to 13 per urban area. The minimum needs per bilingual city are 2 English, 2 French and 2 educational programs, a total of six.

FM -- Since all available FM channels have been put in service in the larger cities, there would be a shortage of channels if FM output is made mass-appeal programming with advertising potential.

Auxiliary Services -- Dedicated channels for studio-to-transmitter links, standby, and outside broadcasts should be provided to each station. Licensees in the VHF communication bands should be required to exercise circuit discipline in technical standards and usage.

(e) Spectrum Management

AM -- Consider voluntary reassignments in the AM band.

FM -- FM allocations should be studied with the objective of avoiding allocations which interfere with television channel 6.

Auxiliary Services -- Consideration should be given to sharing rather than duplicating services in the VHF band. Use of digital information for some communication (e.g. dispatching) should be considered.

(f) Economic Worth of Spectrum

The physical worth of the spectrum appears to be:

Radio (AM)	\$255 million per MHz per annum
Radio (AM & FM)	\$12.8 million per MHz per annum
Television	\$ 4.9 million per MHz per annum

Methods of measuring the social value of programs have not yet been developed.

2. Land, Air, Marine, Mobile and Associated Fixed Services Task Force -- Summary of Recommendations and Conclusions

(1) The continued growth of land mobile services as a result of its vast economic and social benefits, can be expected to result in an acute shortage of channels by about the year 1980. To meet future needs these channels would be most logically provided as part of an overall North American Plan by re-allocation from broadcasting channels, for example, TV channels 14-20. Considerable spectrum space is wasted due to low efficiency systems.

(2) Within the scope of such a plan there should be maximum flexibility in spectrum allocation to encourage maximum usage of spectrum.

(3) Manufacturers should not be pressured to develop increasingly sophisticated and expensive means to accommodate more users until such time as low efficiency systems such as radar, FM and TV broadcasting have matched up to the standards being achieved in land mobile, HF point-to-point and AM broadcasting services, for example.

(4) Pollution is restricting efficient use of the spectrum.

(5) The radio frequency spectrum should be reserved primarily for those requirements that may not be practical over other means.

(6) In order to speed up licence applications some form of pre-processing of frequencies and stream lining of procedure appears to be needed.

(7) A price should not be put on use of spectrum, as a prime consideration.

(8) When there is a shortage of spectrum, priority in the allocation of frequencies should be given to services essential to the public interest.

(9) Users should be free to choose between leased and privately owned facilities.

(10) Licences should normally be granted for a definite term, preferably corresponding to the period over which radio plant is amortized. In any case the applicant should be made aware of any plans which would unusually limit life expectations.

(11) Telephone companies should offer some form of interconnection to the public telephone network on a [illegible] agreeable basis and at readily ascertainable rates.*

(12) (a) Modifications to DOC equipment standards specifications are necessary.

(b) Policy level conferences between DOC, EIA, and CRTPB are recommended to re-define the philosophy and policy of equipment technical specifications.*

(13) With increasing diversity of users for mobile communications, user groups representing specific industries or public safety organizations should be encouraged to participate in the activities of the CRTPB.

(14) With a new creative role for DOC for the future, increasing time should be spent with specific user organizations across the country to determine the particular uses of the spectrum and system concepts which will promote efficiency and productivity. There should be additionally increasing efforts in working with EIAC in paving the way for the new technological developments of the future.

(15) Increasing uniformity of technical standards among the various radio services is encouraged.

(16) There should be flexibility to accommodate new technology and needs.

(17) There is a need for spectrum space outside the mobile bands for low capacity (up to 60 voice channels) point-to-point systems in an area not subject to ISM interference.

(18) It is important to recognize, that looking at the entire spectrum, there is an allocation problem upon us rather than a spectrum shortage problem for the next decade or more. It is the Task Force's position that this simple fact renders proposals for charging for use of the spectrum undesirable. Use of the radio spectrum, a natural resource, should be encouraged to the benefit of the country.

*Consensus opinion on these two items only.

3. Microwave Task Force -- Summary of Recommendations and Conclusions

(1) To date there has been no shortage of spectrum space for microwave systems above 1000 MHz in Canada.

(2) Spectrum saturation will occur in urban areas in the near future. Good spectrum management will require close co-operation by the regulating authorities, users and manufacturers.

(3) A permanent committee should be established by the C.R.T.P.B. to analyze growth trends in microwave systems, and general problems with respect to microwave system spectrum management. This committee would be representative of users and manufacturers and would arrive at recommendations for processing to Department of Communications through the normal C.R.T.P.B. procedures.

(4) A procedure should be established by the Department of Communications to provide for the collection of spectrum usage data and its publication on a continuing basis. This would form the basis for forecasting the growth of spectrum usage in Canada.

(5) The present Department of Communications procedure of frequency allocation based on capacity and performance requirements should be retained. The allocation of complete frequency bands exclusively to specific classes of users is not recommended.

(6) All Canadian non-standard frequency plans in use should be identified by the Department of Communications and analyzed to determine if they are affecting new growth. Extensions to a non-standard plan should not be considered except under unusual circumstances.

(7) The Department of Communications should establish a procedure to review, at time of license renewal, or other convenient interval, actual circuit usage of an RF channel, as compared with initial forecast of usage.

(8) Prior to the adoption of a policy or regulation, licensees or other interested persons should be afforded a reasonable opportunity to make representations where such policies and regulations affect use of the radio spectrum.

(9) The committee considers the C.R.T.P.B. to be an effective liaison body between the regulatory body (Department of Communications) and the users and manufacturers. It believes that this liaison should be strengthened.

(10) It is recommended that no attempt be made to place a dollar value on the spectrum. Variation of license fees

related to usage (e.g. power, bandwidth and other indicators) seems to be the most practical means for encouraging efficient use of spectrum.

4. Other Services Task Force -- Summary of Principal Findings and Recommendations

(1) The Committee finds that frequency assignment records of the radio spectrum below 30 MHz do not represent true occupancy or use. Statistics on this are not known. Nonetheless, assuming all recorded assignments are in use, the spectrum below 30 MHz is not congested except in discrete slots and special situations. Utilization below 30 MHz appears to be increasing at the rate of about 10% a year.

The Committee recommends that the DOC determine, on a continuing basis, accurate statistics on spectrum occupancy and use below 30 MHz, since this data is prerequisite to management of these bands.

(2) The Committee finds that the present priorities identified by the International Telecommunications Union table of allocations are satisfactory but recommends that licensing be permitted in Canada on both a shared service and a geographical (regional) basis wherever it can be shown that no interference will result.

(3) The Committee finds that systems engineering below 30 MHz is generally weak and recommends that this be corrected by wider distribution of related information to the user public, and the introduction of a requirement for an appropriate system engineering brief to cover these services and, with respect to specific technology, recommends that the transition to single sideband hardware be accelerated.

(4) The Committee finds that present spectrum management seems to emphasize the equipment radio standards specification and recommends that, while this aspect must always pertain, other elements of the science of spectrum management must be employed in appropriate ratio.

(5) The Committee finds that the level of man-made noise is steadily increasing and recommends that this situation be watched closely so that additional control can be implemented if and when this becomes necessary.

(6) The Committee finds that the present license term (years to renewal) bears no formal relationship to the applicant's system proposal and investment in plant and recommends that this situation be corrected.

(7) The Committee finds that while it could identify instances where the spectrum does have considerable material value, it was unable to develop an economic formula appropriate to every case and to the spectrum as a whole.

(8) The Committee finds that the radio spectrum is a National resource belonging to all Canadians who, consequently, have the right to know Government spectrum policy and the obligation to participate in its formulation.

The Committee recommends that the Minister of Communications continue to be the public custodian of this National resource with primary responsibility for the formulation of policies relating to management of the radio spectrum in Canada.

(9) The Committee finds that the flow of information between the spectrum managers, the technologists, and the end users is somewhat archaic and inhibiting and recommends that these activities be modernized as quickly as possible.

(10) The Committee finds that the need for modern below 30 MHz hardware and systems suitable for the Canadian North is not being fully met and recommends that Canada exploit this unique opportunity for world prominence in Northern telecommunications science.

Telecommission Study 2(h) Re-Appraisal of the Present Management of the Frequency Spectrum

July 1970

President's Remarks

J.C.R. Punchard

Within the short time span of the Telecommission, (less than one year), it is believed that Part II of this study conveys a fairly comprehensive picture of the use of the radio spectrum in Canada with suggestions for improved spectrum management. By request of the Department of Communications, no attempt has been made to go into extensive detail concerning actual frequency assignments. The task forces doing this work were asked to provide descriptions of existing conditions and to discuss principles having a bearing on efficient spectrum management.

Summarizing a 700 page document in a few words is a difficult task, but a few comments on the work of each task force can probably reveal most of the important issues.

From a technical standpoint, the regulation of the spectrum for AM, FM and TV broadcasting has been well planned, allocated and administered. Local spectrum congestion and interference are of course present in varying degrees, mainly due to rapid growth. It is becoming apparent that receiver quality standards have fallen behind transmitter standards. The introduction of cable systems between transmitters and receivers must inevitably require improvements in receiver quality and the imposition of cable quality standards. New techniques are available which will improve efficiency of spectrum use for broadcast purposes, but since these require special transmitting and receiving equipment, their introduction will be quite slow.

Saturation of available channels for AM, and FM broadcasting has nearly been reached in the larger cities. Provision of significant increases in the number of stations in the next ten to thirty years to match expected population growth will call for some radical solutions. The obvious technical solution for the conservation of spectrum in urban areas is the use of paired cable for radio type (audio) broadcasting and coaxial cable for television. The economics involved may well be staggering and will undoubtedly be the limiting factor.

The physical worth of the use of the spectrum for broadcasting can be fairly readily calculated, but methods for measuring the true social value of programming are not yet available. Research in this area is badly needed before the techniques for planning new telecommunication systems can be fully comprehensive by taking into account all of the important factors involved.

The most startling factor in spectrum use has been the phenominal growth of mobile services in the last twenty years. Every indication points to continued growth and increasing pressures for more and more mobile services of many kinds. Since such services can only be provided by means of radio, it seems obvious that the existing mobile radio bands must be used with the utmost efficiency. This will entail the best possible spectrum management and improvements in equipment for conservation of bandwidth. Much has already been done to minimize bandwidth, but complexity and cost is rapidly bringing about a condition of minimum return on the investment for development. Within ten to twenty years the presently allocated spectrum will become overcrowded in many areas and some means must be found to increase the amount of spectrum available for mobile services. It is of course obvious to look to spectrum now allocated to services which could function, at least in part, through future systems which do not use the radio spectrum. Although there are many economic, political and technical implications involved, it is suggested that serious study be given now by D.O.C. to determine the best overall solution to this problem which will be fair and equitable to all concerned.

No discussion of efficiency of spectrum use would be complete if it ignored the amount now allocated for military purposes. Since Canada's military forces are declining and assuming new roles, their need for frequency space should be re-examined. Obviously, Canada's national security must in no way be jeopardized or compromised, but since frequency spectrum is a national resource, its' use should be considered on a practical, holistic basis if the nation is to prosper. Perhaps some of the spectrum now allocated to the military could be used on a temporary basis in peace time by commercial interests, to be cancelled when a contingency arises. Planning for such an arrangement should begin now, before such requirements are imperative.

Spectrum saturation in the microwave bands is being approached in some urban areas in Canada. To make best future use of spectrum available, very careful and intelligent planning, founded upon accurate data of present usage and forecast data of future usage, will be required on the part of both the D.O.C. and the users. The industry recommends the establishment of a permanent committee sponsored by C.R.T.P.B. to continually review and analyse problems of microwave spectrum management in Canada. The principle of flexibility, taking into account

changing needs, actual and forecast usage and new technology must be applied and will be essential to efficient spectrum management.

About half the members of the Microwave Task Force were not in favour of including Table 2, page 55 of Microwave Task Force Report on the grounds that it could be taken out of context with consequent impression of poor performance.

In Part II of the study the Other Services Task Force, which was to have considered all services other than broadcast, mobile and microwave, only covered services below 30 MHz. There is therefore no comment referring to radar, navigational aids, diathermy, industrial processing equipment or VHF point-to-point services. It would seem desirable to have this task force continue its work in the Fall of 1970 and submit a supplementary report in 1971.

While there are increasing requirements for licensing in the High Frequency spectrum year by year, the extensive development of reliable services in the region above 30 MHz has undoubtedly reduced the overall demand for services below 30 MHz. The main problems of interference and congestion below 30 MHz seem to stem from the continued use of double sideband equipment, poor receiver selectivity and frequency control. The introduction of single side band equipment should materially improve these factors and the efficiency of use of this part of the spectrum. Poor system design of small HF systems in Canada's isolated areas gives cause for concern. It would seem reasonable for D.O.C. to tighten system requirements to insure that such stations are properly engineered.

Since the radio noise level is gradually rising all over the country, it is imperative that the importance of this type of man-made spectrum pollution be recognized now. Steps should be taken immediately by D.O.C. to study and assess this condition on a continuing basis so that more severe steps may be taken before noise pollution reaches intolerable levels in the future.

Analysis has shown that spectrum between 7 and 30 MHz is only lightly used commercially in Canada. It is thought that more widespread dissemination of ionospheric propagation knowledge by D.O.C. will bring about greater use of these frequencies through improved system reliability.

The industry fully recognizes the privilege it has enjoyed over the past 25 years in working with the radio regulation branch of the Federal Government through the C.R.T.P.B. Although there are, and always will be, interference and performance problems, it is believed that the procedures developed for the fullest co-operation of the telecommunication industry with the government have added immeasureably to the efficient technical use of the radio spectrum in Canada. The "review"

function of the Board must continue and be enlarged in capacity and speeded up. The "planning" function, which is exemplified in Part II of this study, has seldom been exercised in the past, mainly due to the fact that it has not been organized. Sponsor members are becoming increasingly aware of the urgent need for closer co-operation with D.O.C. for the future administration of such a vital and important national resource as the frequency spectrum.

The financial assistance given by D.O.C. to C.R.T.P.B. has resulted in a very considerable step up in the volume of work handled by this organization over the past few years. Since the volume and complexity of the work will continue to increase in future, it is obvious that further work in both review and planning areas will require increased financial support of C.R.T.P.B. by D.O.C. and by its own sponsors. The C.R.T.P.B. is a unique organization in its relationship with the Federal Government. It has been and can continue to be a most effective instrument for sounding the telecommunication industry on spectrum management matters of national interest.

It is evident from a review of Part II 2(h) that many of the problem areas covered by the four task forces differ considerably as evidenced by their respective conclusions and recommendations. Although it may seem self-evident, we believe it is important to point out that future government policies, regulations and procedures concerning the management of the frequency spectrum will have to vary to fully accommodate the differing characteristics of the frequency bands and/or services.

Canadian Electrical Association

Comments on Telecommission Study 2(h)

Report of Task Forces I to IV; Part II of Two Parts

The C.E.A. agrees in general with the conclusions of the task forces, including the conclusions of the Microwave Task Force but does not agree with the implications of "efficiency" in the second of the conclusions (page 20 of the Microwave Task Force Report).*

This implies that all equivalent voice channels are of the same value to the public. When proper operation of just one telecontrol channel can prevent a widespread power black-out, with all the accompanying public hardship, we cannot see how all E.V.C.'s can be considered to be of the same value to the public.

We feel that the end use to which a spectrum assignment is put is an essential factor in judging the value of the public, and cannot be left out or averaged.

We would suggest that the last sentences should be re-worded to read:

> "There is and will be a need for these systems. It is important that the spectrum required for them be related to both the amount of spectrum available, and the value of the signals that they carry."

With the above comments in mind, the Canadian Electrical Association agrees with the report.

APD
August 11, 1970

* See page 72.

COMMENTS OF THE CANADIAN ASSOCIATION OF BROADCASTERS TO THE CANADIAN RADIO TECHNICAL PLANNING BOARD RE NOTICE 908/70 OF JULY 17, 1970

THE RE-APPRAISAL OF PRESENT MANAGEMENT OF THE FREQUENCY SPECTRUM REPORT OF TASK FORCES I TO IV PART TWO OF TWO PARTS TELECOMMISSION STUDY 2(h)

The Canadian Association of Broadcasters have examined the forementioned Task Forces reports and is impressed with the extent and the amount of research and work that has gone into their preparation. It is believed that the Department of Communications studies of this document will be of great value in their technical administration of radio.

There are, however, several points raised in the various reports where the Canadian Association of Broadcasters feels comment would be appropriate.

In the comments of the Canadian Cable Television Association appended to the report of the Task Force on Broadcasting, a statement is made that "Broadcasting is without doubt the one radio service which is the most wasteful user of the frequency spectrum". The implication of this same statement appears also in the principle conclusions and recommendations of the Land, Air, Marine, Mobile and Fixed Task Force.

The Canadian Association of Broadcasters feels that it must comment in respect to the technical implications implied in these statements. When it is considered that the transmission of a television signal comprises not only the dynamic visual information, but the colour information and the audio components of the signal, it is believed that the present system of a 6 megahertz bandwidth is one of compatibility with the state of the art. We are sure that it is realized that the 525 line system used in the United States and Canada provides what may be considered an adequate picture, nevertheless, certain other countries feel that a greater number of lines must be used to gain a finer texture for the picture re-production and the use of 625 lines is not uncommon in Europe and requires an 8 megahertz bandwidth. It is our understanding that even those European countries which may have used and still use a lower number of lines are looking towards the incorporatic of 625 line minimum standards to improve picture definition.

Our submission to Telecommission Study 1(d) contained as part of its voluminous documentation a copy of an article by Dr. Franz Josef In Der Smitten on the "possible developments in radio and television techniques in the next few decades". This article was re-printed with the permission of the author and the European Broadcasting Union. We are sure that the Telecommission will benefit from the contribution in this connection. It is our belief that the foregoing statement is coupled with the presumption that cable systems will in the future supplant broadcasting over the air. Our experience in the Television Committee in the Canadian Radio Technical Planning Board when it was considering Broadcast Procedure 23 during the early part of this year clearly demonstrated to us that the status of CATV systems at this time is such as to preclude the complete carriage of television programming particularly of local stations without deterioration of the signals thereof. It may be some considerable time before equipment capable of carrying television signals without degradation is in use in cable and in community antenna television systems and it would be indeed unfortunate if the impression was left that such a change could take place over night. In any case, it is not our belief that CATV systems can possibly supplant television broadcasting and the public of Canada which is served by the present system will require on-the-air broadcasting for many years to come.

Far from being an inefficient system of transmission of intelligence to the public of Canada, broadcasting does in fact serve more people simultaneously than any other form of radio communication in use at this time.

The aforementioned Land, Air, Marine, Mobile and Fixed Task Force has made many worthwhile recommendations in its report, nevertheless, the Canadian Association of Broadcasters must express the firm conviction that the recommendations number 1 and 3 pertaining to the use of television broadcasting channels for land mobile service would work to the detriment of Canadian Broadcasting in the future in Canada.

We are pleased to observe that in the recommendations of the forementioned Task Force no reference is made to a present extreme congestion of the frequencies examined by this group which would warrant immediate action in this respect and it is our belief that continued studies by the Department of Communications may well bring solutions to the problems now facing the industry without recourse to the use of broadcasting channels.

Canada has followed a frequency allocation program for a number of years based on the concept of flexibility, and avoided the strict regulated form of control as used by the Federal Communications Commission in the United States. It is our belief that this action in Canada has resulted in greater access to frequency usage for Canadian station operators than that possible under the system used in the country south of us. It would be unfortunate if Canada were to tie her allocation principles into those applied in the United States. Our rate of implementation is lower and our flexibility has permitted the licensing of many more stations in proportion. It should also be emphasized that much of the orderly growth resulting in Canada has arisen from the application of sane and sensible technical specifications designed with the objective of protecting the users and affording maximum use with minimum frequency occupation. It is hoped that this trend will continue in the future.

The Canadian Association of Broadcasters is fully aware of the extensive studies and submissions made to the Federal Communications Commission of the United States in relation to land mobile congestion and has noted with interest that the Federal Communications Commission have proceeded with great caution and have not on a wholesale manner adopted the original proposals before them. It is our understanding that continued submissions are being made to the Commission in relation to the use of broadcasting frequencies by land mobile systems and that considerable and extensive testing and experimentation may be necessary to ascertain whether such operations are in fact practical. It is our earnest hope that the Canadian authorities will not by precipitant action apply a system of sharing on the broadcasting channels without an extensive and thorough study of all the factors involved.

It is our belief that such a study could only be undertaken effectively by an independent scientific organization. If the Department of Communications feels that such study is beyond the scope of their resources we would then strongly recommend that the National Research Council with its extensive facilities undertake such an examination of spectrum usage.

We do not believe that the Canadian Radio Technical Planning Board which for years has served a most useful and constructive purpose in bringing to the attention to the Government the views of manufacturers and users of the spectrum is the proper body to carry out such an investigation because obviously as evidence through the years, the CRTPB can only express to the D.O.C. the diversified opinions which may arise under certain circumstances.

The CAB wishes to reaffirm its position of being definitely opposed to permit sharing by the Land, Fixed and Mobile Services of the UHF or any other channels allocated in Canada to broadcasting.

It is believed that such action is contrary to the intent of the will of Parliament as specifically expressed by the Broadcasting Act of 1968 and will curtail the freedom of action of the Canadian Radio Television Commission in implementing its mandate to ensure adequate broadcasting service to Canadians. In any case it is doubtful that such sharing could be contemplated without serious consideration by the CRTC and no doubt public hearings.

We might add that the escalating demand for broadcast services, which is really being enhanced by CATV developments, likely will result in the U.H.F. channels being used on an increasing scale in the next few years. As viewers become used to a variety of channels, the desire for domestic service grows and the realities of an ultimate ceiling for CATV saturations of some 50-60% is reached, the have-nots will make their voice heard and demand more broadcast service.

We are aware of the position of the FCC in the USA and wish to urge that the Canadian authorities take all necessary action to forestall interference to Canadian use of the full potential of our UHF broadcasting channels in border areas.

It is noted that in particular the FCC propose higher levels of interference in certain population centers than in others and some of these high interference levels are being permitted in communities adjacent to the Canadian border.

It would seem inappropriate at this time to jeopardize the future of Canadian broadcasting when there exists frequency capacity within the spectrum for Fixed and Land Mobile use outside the broadcasting allocations and which is unused or relatively lightly used at present.

T.J. Allard,
Executive Vice-President.
August 12, 1970.

Telecommission Study 2(h)

Report of Task Forces I to IV

Comments By

The American Radio Relay League, Canadian Division

This organization has no real argument with any of the findings or recommendations of the four Task Forces involved in the study. Many of these of course do not involve the Amateur Experimental Service, and are not applicable in many cases to Canadian Amateurs.

There are, however, certain comments contained in the various reports which do apply, and the following paragraphs deal with four of these.

1. Poor AM and FM and TV Receivers

In several places throughout the various reports reference is made to the deficiencies of domestic AM, FM and TV receivers, with particular reference to susceptibility to interference from other services. With this, any amateur would agree heartily. Since most amateur transmitters are of their very nature located in residential areas, perhaps no service has had so many complaints of interference with domestic receivers as the Amateur Service. A very large proportion of this interference is caused by design deficiencies in the receivers themselves, and no amount of work at the transmitter can cure the interference. While appreciating that economic factors are involved to a very great extent, the League's Canadian Division would heartily endorse any effort made to improve the quality of domestic receivers sold to the non-technical public.

2. Spectrum Pollution

Throughout the various reports there is frequent reference to pollution of the radio spectrum, primarily from man-made noise, but also to a lesser extent from unauthorized operation of radio transmitters in portions of the spectrum assigned to other services. While the Department of Communications has the authority to seek out and force the cure of man-made interference, it has neither the finances nor the personnel and equipment to deal with the problem on anything like an adequate basis. It would appear to be much more logical to require the suppression of interference from such devices at the time of manufacture,

when it could be done much more cheapily than effecting a cure at a later date. Dealing with unauthorized radio transmitters is of course more difficult, since these are in many cases located in Countries who are not members of the International Telecommunications Union, although broadcast interference, particularly on the 7 Mhz band often originates in some of the major European Countries. While amateur organizations both in Canada and abroad have had some success in having their Governments complain of such interference, there still remains a great deal to be done in ridding our internationally assigned frequencies of these "intruders".

3. Economic Value of Spectrum Space

All four Task Forces which took part in this study attempted in one way or another to place an economic value on frequency assignments with little or no success. With the general conclusion that evaluating spectrum space is difficult, if not impossible, there can be little argument, and with the general recommendation that such a yard stick should not be applied to license fees, this organization would agree. In addition, it should be pointed out that the Amateur Experimental Service is by international and national regulations prohibited from deriving any financial remumeration from the use of spectrum space. Of its very nature, the Amateur Service has no means of deriving financial benefit from the frequencies assigned to it, and it would, therefore, appear to be virtually impossible to evaluate such allocations.

4. Longer Term Licenses

With the suggestion made in several places that longer term licenses should be made available, the League's Canadian Division, must agree. In fact, such a suggestion has been made more than once to the Department of Transport and it's successor the Department of Communications. This would result in much less paper work, within the Department itself, and greatly reduce their cost of operation.

TELECOMMISSION STUDY 2(h)

Report of Task Forces I to IV

Comments by

Association of Municipal Electrical Utilities of Ontario

This document represents a great deal of effort on the part of the participants and in the areas of concern to the A.M.E.U. we are pleased with the report as compiled.

In particular we believe the Land, Fixed & Mobile Service should receive a very high order of priority in spectrum assignments.

ELECTRONIC INDUSTRIES ASSOCIATION OF CANADA
COMMENTS ON TELECOMMISSION STUDY 2(h)
REPORT OF TASK FORCES I TO IV; PART II OF TWO PARTS

TASK FORCE I
BROADCAST SERVICES TASK FORCE

1. We take serious exception to the suggestion made under the heading Auxiliary Services (Conclusion (e) P. 8) that taxis, trucks, ambulances, etc., represent low utilization services. These services are among the heaviest channel users, particularly the taxis and trucks which do share frequencies wherever it is practical. The useage by broadcast stations for remote pick-up and other non-scheduled requirements represents an extremely low useage in contrast with other services mentioned.

2. To suggest that sharing could most effectively be done by assigning channels to a "common carrier" which would use the channel "searching" process, is contrary to the experience of the Land Mobile Industry as described in the EIA of C report section VII, 3.3. This method of obtaining service may suit the Broadcasters but it would not suit the thousands of users making up the Land Mobile Service in Canada.

3. The Telephone Association of Canada makes a flat, unsupported statement that all potential users should be encouraged to obtain their services from the common carriers. We disagree with such an approach as it would reduce free competition and remove the progressive forces of innovation and new technology from providing the direct benefits possible at the earliest possible time. Industry has shown itself capable of dealing effectively with complex users' needs and pushing technological development to the full when unfettered by a monopalistic system of distribution of services.

4. We would support the suggestion that minimum standards be established for receivers to help reduce interference experienced by users of current equipment.

5. The C.B.C. report on Auxiliary Services is an objective approach which seems to touch on the broad spectrum of the services needed and problems encountered.

TASK FORCE II
LAND AIR MARINE MOBILE AND ASSOCIATED
FIXED SERVICES TASK FORCE

As EIA of C has been involved in this part of the study, we have no further comments.

TASK FORCE III
MICROWAVE SERVICES TASK FORCE

As EIA of C has been involved in this part of the study, we have no further comments.

TASK FORCE IV

This report is quite comprehensive of the situation today which involves International Regulations and Agreements. The report is a good source of data and makes many suggestions of value to the management of the spectrum.

THE TELEPHONE ASSOCIATION OF CANADA/TRANS-CANADA TELEPHONE SYSTEM

COMMENTS ON PART II OF TELECOMMISSION STUDY 2(h)

Although the four Task Forces approached the subject in somewhat different manners using the same terms of reference, the conclusions reached have some common [illegible] conclusion is that spectrum management and allocation in the past have been sufficiently good that no shortage of spectrum now exists. Therefore, many of the existing policies and procedures are satisfactory and wholesale changes need not be introduced.

Each of the Task Forces has studied certain aspects of the subject in varying depths of detail and hence the absence of comment in one section does not imply acceptance of any recommendation by any other Task Force or even acceptance by a Task Force of a statement in a contribution by a specific organization. In particular, the report of the Land, Air, Marine, Mobile and Fixed Task Force is so voluminous and portions of it were introduced so late that not even adequate time was available to properly reflect on the conclusions of that Task Force. The conclusions and recommendations therefore relate only to the appropriate subject and portion of the frequency spectrum involved. Within this context, we agree with and support the conclusions and recommendations of the various Task Forces, with the exceptions noted below concerning the Land, Air, Marine, Mobile and Fixed Task Force.

The use of terms appears not to be necessarily consistent throughout the whole report and in many cases remain undefined or unusually vague. A [illegible] appears [illegible]. The Microwave Task Force has introduced an efficiency factor which would be misleading if not taken in its proper context. For example, the theoretical formula results in an efficiency factor for the land mobile using 30 khz spacing of only 4/30 or 13%.

The following comments apply speci[illegible]y to the Land, Air, Marine, Mobile and Fixed Task Force Report. The Telephone Association of Canada feels that the section on principal conclusions and recommendations should reflect the opinions of all the Task Force and that diverging views should be clearly identified. The explanation of the asterisk footnote "consensus opinion only" suggests general agreement on these items which we feel did not exist, and we would recommend that this footnote be changed to "views of some members of the Task Force only on thes[illegible]"

As an alternative, the following wordi[illegible] would be acceptable to us and are suggested as a rep[illegible].

Item II - Certain owners and/or operators of private telecommunication facilities feel that Telephone Companies should offer some form of interconnection to the public telephone network. The Trans-Canada Telephone System view-

point is expressed in the contribution to Telecommission 8(b), "Study of Interconnection of Systems, Circuits, Devices", and elsewhere.

Item 12B - Conferences between DOC and CRTPB are recommended to discuss the philosophy and policy of equipment technical specifications.

In addition, to support the other items in the summary, we believe that the minor wording changes shown below better reflect the thoughts and ideas contained in items 3, 5, 9 and 14.

Item 3 - Consideration should be given to the use of increasingly sophisticated and expensive means to accommodate more users in different bands of the spectrum with particular emphasis on such systems as radar, FM and TV broadcasting.

Item 5 - Priority in the use of the radio frequency spectrum should be given to those requirements which may not be practically provided by other means.

Item 9 - Users should be free to choose between leased and privately owned facilities provided the choice is consistent with public interest.

Item 14 - DOC should spend increasing time with specific user organizations and manufacturers across the country to determine the particular uses of the spectrum and system concepts which will promote efficiency and productivity. There should be additionally increasing consultation with the R&D segment of the industry in paving the way for the new technological developments of the future.

Also, we note an error on page 21 of the Report where under section 2.3, Public Radio-Paging, Highband VHF, it should read, "There are approximately 30 systems with 1600 subscribers on the 150 Mhz band. There is rapid expansion." These figures applied at the time of preparation of the Report, although they are undoubtedly exceeded now.

ERA/hl
24 Aug 1970

COMMENTS

ON THE

TELECOMMISSION STUDY 2(h)

BY THE

WESTERN CANADA TELECOMMUNICATIONS COUNCIL

JUNE 1970

VANCOUVER B.C.

Introduction

The Western Canada Telecommunications Council (WCTC) is an organization composed of users, manufacturers and organizations concerned with the use of telecommunications in Western Canada. A membership list is attached as Appendix I.

The Council has been in existence 14 years and holds regular meetings to discuss and advise the Department of Communications, formerly the Department of Transport, and the Canadian Radio Technical Planning Board (CRTPB) on matters concerning equipment specifications and the efficient use of the radio spectrum. The Council also performs a liaison between the Department of Communications and many user members who are not technically staffed to liaise on a direct basis.

What has the WCTC done towards the preparation of this submission? Five task forces were established from the membership of the WCTC and non-members with an interest in the future of spectrum management. These task forces, under the direction of the WCTC Executive, had meetings and developed recommendations and observations which were presented to a public meeting and discussed on an open forum basis. This submission is intended to relate to the Telecommission the recommendations and observations of these interested parties.

The WCTC task forces used the guide lines for study established by the CRTPB. The WCTC's findings and conclusions are in line with those of the CRTPB and its report is endorsed by this Council as submitted. In addition the WCTC wishes to bring to the attention of the Telecommission the

following observations which are considered salient to the subject and to the industry in Western Canada.

Background

At the meetings and discussions conducted, those involved in the Telecommunications industry in Western Canada have expressed serious concern as to the full intent behind the Telecommission study and its implication on the future availability of spectrum as it was originally provided for under the terms of the Radio Act. We, the members of the WCTC, would like to re-affirm our understanding of the Radio Act - "THE RADIO SPECTRUM IS A RESOURCE BELONGING TO THE PEOPLE OF CANADA".

The spectrum is not like a resource such as timber or minerals which can be reserved for future use. It is like time. It must be used or it is wasted and the benefit lost forever.

The policies and regulations that have guided the industry in the past number of years have very successfully stimulated development of the spectrum. The Department of Transport, whose responsibility it was to manage this development, did its job well as referenced by the very few spectrum problems in evidence today. However, this is not to say that the needs of the future can be effectively met by these same policies and regulations but must adapt to new needs as they arise without becoming restrictive to the continued orderly development of the spectrum.

Radio services have played a major role in the development of the rich natural resources located in the sparsely populated areas of Western Canada. These natural resources are an essential part of the economy and future of Canada and their development should not be inhibited by a restrictive spectrum management policy.

Recommendations & Observations

The following comprise the essence of the recommendations and observations made by the WCTC task forces and the general public meeting:

1) Canada, a developing country, is often regarded as an international leader. Due to the past knowledgeable and sensible approach to spectrum management, and in representations internationally, Canada is held in high regard within the International Telecommunications Union.

   The growth of satellite communications, and the increasing number of users employing the low frequencies with international propogation characteristics, suggest that Canada will have an even larger international role to play in the future. Will Canada be able to maintain its leadership image with the new policies and organization of the Department of Communications? Technical knowledge and the ability to sensibly manage the spectrum in Canada, within the framework of the Radio Act, were the criteria in the past.

2) Who should be permitted to use the spectrum? Government, business and individuals (the people of Canada) who have a need and who can

meet the technical requirements as established to ensure good spectrum management should be permitted to use it. It has been suggested that two further criteria for judgment be employed - social and economic. In a free enterprise, democratic country, it is difficult to conceive any communication facility provided to bring people closer together or to improve the safety and/or efficiency of our business and people as not being a social asset. Justification relating to economics is a decision always made by the investor prior to the requisition and installation of a communications system. Who is best equipped and responsible to make this decision? It is surely not a Government Department!

If new Government policy is needed to control capital investment by Canadian industry, the WCTC does not agree that the lever of restrictive licensing should be employed. A spade should be called a spade!

3) The WCTC agrees, it must deal with the situation as it is. It would not be necessary to outline such obvious factors governing the radio spectrum if it were not for recent situations which have developed under the Department of Communications in which:

- Large responsible public utilities have been denied use of spectrum for power control and regulation.
- Provincial Government agencies have been denied use of spectrum to provide television service for their population.

- A Provincial Railway has been denied use of spectrum for system expansions.
- Major Canadian electronic manufacturing companies are being denied their market due to restrictive licensing policies.

The reasons given for denial are not lack of spectrum, but questionably, for economic and social reasons. Who is the best judge of economic justification - the investor or a newly formed Government Department? What are the social implications of not allowing these projects to proceed? The Department of Communications should consider this aspect which would be a more positive approach.

4) Regulations developed for spectrum management should relate to the actual Canadian situation. The vast majority of Canada is rural and undeveloped, in particular, Western Canada. In rural Canada there is no spectrum congestion nor is it anticipated in the foreseeable future. Communications is a vital ingredient in pushing back the frontier and should be encouraged by the Government. It is proposed that this be done through intelligent application of specifications and through economic incentives.

5) Nobody owns the spectrum - the Government manages it by licensing frequencies on one to five year intervals - not in perpetuity.

It has been noted that the Department of Communications has shown reluctance to assign frequencies on the basis that withdrawal of the assignment may be necessary at some future date.

To develop the spectrum, the Department of Communications should feel free to allocate existing spectrum, and to exercise its power to cancel or re-allocate frequencies, as new technology or as higher priority needs arise. On the same basis, prospective users should be given the opportunity to make the decision whether to employ the spectrum based on possible future cancellation of license or changes in frequency allocation.

6) The past ability of Canadian industry to install custom communication systems has resulted in major cost savings over leased facilities and substantial improvements in time required to obtain service.

There is no technical or operating requirement whereby private operating systems should be built at extra cost to a standard that would allow them to interconnect with Common Carrier facilities unless it is the desire of the user to interconnect.

7) Technological developments in the electronics industries have made possible new ways to provide communication facilities which are more efficient in the use of the spectrum. The current and projected growth of such development is rapid. To ensure that maximum benefit is derived, there is a continuous need for close liaison between the Government regulating bodies, users and manufacturers. The WCTC provides such a liaison and it is hoped its future relationship with the Department of Communications will be encouraged and allowed to grow.

Conclusion

Reappraisal of the legislation and regulations governing the management of the radio spectrum is both desirable and necessary as new needs develop and technology changes.

Any body that undertakes formulation of new policy should include working representation from those who have built a resource of skill and experience in this highly technical assignment - namely the engineers within the Department of Communications and user-supplier bodies, such as the CRTPB and the WCTC.

The WCTC does not believe the changes now evident under the Department of Communications are in the best interests of the people of Canada.

TELECOMMISSION

Study 2(i)

Study of Institutional Structure of Telephone Operating Industries

The Department of Communications

TELECOMMISSION

STUDY 2 (i)

STUDY OF INSTITUTIONAL STRUCTURE OF

TELEPHONE OPERATING INDUSTRIES

SUBMITTED BY

CN/CP TELECOMMUNICATIONS

TRANS-CANADA TELEPHONE SYSTEM

THE TELEPHONE ASSOCIATION OF CANADA

DECEMBER 1970

Available by mail from Information Canada, Ottawa,
and at the following Information Canada bookshops:

HALIFAX
1735 Barrington Street

MONTREAL
1182 St. Catherine Street West

OTTAWA
171 Slater Street

TORONTO
221 Yonge Street

WINNIPEG
393 Portage Avenue

VANCOUVER
657 Granville Street

or through your bookseller

Price: $1.50 Catalogue No. Co41-1/21

Price subject to change without notice

Information Canada
Ottawa, 1971

CN/CP TELECOMMUNICATIONS

TRANS-CANADA TELEPHONE SYSTEM

CONTENTS

TELECOMMISSION STUDY 2 (i)

PART I

INTRODUCTION

Canada's telecommunications needs are served by a comprehensive network of communications systems built by the country's two telecommunications carrier groups: the telephone companies and the telegraph companies.

This Paper documents the development of these systems, tracing briefly their history and organization, comparing the service they provide with that of other countries and describing their achievements and contributions to the growth of Canada.

It attempts to give some impression of the uniqueness of the problems faced by the builders of Canada's national network, and the magnitude of the job of co-ordinating the efforts of the close to 1700 systems whose facilities constitute the total network.

It describes the degree of co-operation achieved by CNT and CPT in constantly improving their ability to provide telegraph service to the nation at minimum total cost, and to expand their competitive strength in the total telecommunications field.

The builders and operators of Canada's telecommunications systems overcame many obstacles in their 124-year history, and although the competitive nature of the two major carrier groups is apparent, each has recognized a need to rely on the other in the interest of ensuring that this vast, thinly-populated country has one of the world's finest networks.

Today, although the problems are much more complex and occur far more frequently, the formula for resolution is still the same: to furnish whatever is required to ensure that Canadians have the best possible telecommunications services at the lowest possible cost.

PART II
SECTION 1

HISTORY

The present development of the telecommunications art in Canada is simply the latest stage in the continuing evolution of man's ability to transmit intelligence. It probably all began with sign language, progressed through spoken and written communication, employed drums, runners, flags and similar devices to bridge distances, finally arriving at the first use of telecommunications, the telegraph.

Probably no industry better illustrates the continuing urge of man to build better. Having arrived at a system that transmitted written words with the speed of light, he continually worked to improve it. Experimenting to develop a telegraph carrier and, as well, a means of helping the deaf, Alexander Graham Bell invented the telephone.

Even though man could speak or write to practically all corners of the world, he still continued to invent and innovate so that today, pictures of events can be broadcast instantly, and all forms of data transmitted at remarkable speeds.

Mankind is on the threshold of -- if not already deeply involved in -- a dramatic "information explosion", presenting him with an even greater challenge to expand his communications capability.

The history of the evolution of telecommunications in Canada stems from the development of the Telegraph and Telephone industries, a brief history of which is individually outlined in this section.

SECTION 2

HISTORY OF THE TELEGRAPH INDUSTRY

The word "telegraph" is composed of two Greek words, "tele", meaning "at a distance" and "grapho", which means "I write". This is indicative of the primary endeavour of CN/CP and its predecessors in the telecommunications field, namely the conveyance of information over distances.

On December 19, 1846, two years after the first public message was transmitted in the United States and approximately 30 years before the advent of the telephone, the first telegram in Canada was sent from Toronto City Hall by the Mayor of that city to his counterpart in Hamilton over the lines of Toronto-Hamilton-Niagara and St. Catharines Electrical Magnetic Telegraph Company. This initial Canadian line was 89 miles long, and at the outset carried an average of 10 to 12 messages a day.

The formation and incorporation of public telegraph companies took place rapidly in Canada following this historical event, and thus followed the pattern of many fledging industries. Companies were formed to serve small areas, and as districts began to overlap, amalgamations ensued.

The first large scale telegraph company, founded in 1847, was known as the Montreal Telegraph Company. In 1871, the Dominion Telegraph Company was incorporated and competed in most of eastern Canada with the Montreal Telegraph Company. By 1881, Western Union's Canadian subsidiary, the Great Northwestern Telegraph Company, secured long-term leases of the

Montreal and Dominion Telegraph Companies. From the beginning of telegraph service in Canada, Western Union, under its own name, served areas later to be known as British Columbia and the Maritime provinces.

To counter the American domination of the telegraph business, the Federal Government granted commercial telecommunications rights to the Canadian railways: Canadian Pacific Railway on February 16, 1881, Canadian Northern Railway in 1902 and Grand Trunk Pacific in 1906. In 1915, the Canadian Northern took control of the Great Northwestern Telegraph Company and its leases. In the latter part of 1920, the Canadian government took over the Canadian Northern and Grand Trunk Pacific Railways. Their respective telegraph companies were also amalgamated and on January 1, 1921, Canadian National Telegraphs was born and charged with the responsibility of providing all the necessary railway communications required by the newly-formed rail system as well as a public telegraph service. In 1924 and 1929, respectively, Western Union abandoned its operations in British Columbia and the Maritimes to the Canadian National Telegraphs Company which then provided rail and public telegraph service across the entire country.

At the end of World War II, the Department of Transport became heir to a major trunk line that connected the Alberta Government Telephones' network on the south with Alaska in the north. This was the famous 1,700 mile Northwest Communications System constructed by the United States Government in 1943 along the general route of the Alaska Highway as part of the defense system of North America. In 1946, the Department of Transport, on behalf of the Canadian Government, entrusted this system to Canadian National to maintain, operate and expand.

During the 1950's, the Canadian National also acquired the properties of the Yukon Telephone Company and in the 1960's the Yellowknife, Hay River and Fort Smith Telephone Companies which were the last privately owned companies in this area of the Northwest Territories.

In 1949, when Newfoundland became Canada's tenth province, the government entrusted the communications operation of the services previously provided by the Newfoundland Posts and Telegraphs to Canadian National. These included public telegraph service, local exchange and toll telephone service to part of the Island and communication services to several major U.S. military installations established during World War II. Prior to 1949, CPT interconnected via Commercial Cable Company with Newfoundland Posts and Telegraphs for the handling of telegrams to the rest of Canada.

Before World War II, CN and CP primarily provided public telegraph message service and acted as communications departments of the parent railways. The end of World War II marked the beginning of large industrial growth, creating a rapidly expanding need for private wire services. It was at this time that the scope of CN and CP operations in the telecommunications industry began to enlarge.

Because of the increasing competitive pressure from the telephone companies, Canadian Pacific and Canadian National pooled their operations in private wire services on August 1, 1947. The "pooling" arrangement was so successful that it has since been gradually expanded to include other service areas such as Telex and Broadband, and in the construction of a jointly-owned transcontinental microwave system.

Until 1968, the only "service" provided by CPT and CNT which was not on a "joint Basis" was the telegram. Competition in this area remained very keen. However, the constant increase in the costs associated with message handling made it mandatory that steps be taken to eliminate the duplication of effort and costs. Out of this decision evolved the Reciprocal Withdrawal Program in the message handling field. Since March 15, 1968, Canadian Pacific has withdrawn from 43 cities, and Canadian National from 34. This procedure, along with the complete interchange of traffic between the two systems, actually places the public telegraph service in the same position with respect to the two companies as if it were joint, but with each company retaining its traditional share of the business.

This process of merging of CN and CP Telecommunications has strengthened their competitive efforts within the telecommunications industry and will become more effective with further refinements. Individually, CN Telegraphs and CP Telecommunications have grown over the years with the Canadian economy, and collectively will play an increasingly important role in the development of the country. They have consistently demonstrated their initiative in the development of new services for communications, such as Telex in 1964 and Broadband Service in 1967, and welcome the challenges of the future to meet the needs of business and the public at large for more advanced and greatly expanded telecommunications services at fair and reasonable prices.

SECTION 3

HISTORY OF THE TELEPHONE INDUSTRY

With the invention of the telephone in 1874, the foundations of today's telephone companies were laid. One of the early significant uses of the telephone was for the collection and distribution of telegraph messages. Telegraph companies, recognizing this advantage to their business, operated telephone systems in Canada for a short time. Some of these were Western Union, Dominion Telegraph Company, and the Montreal Telegraph Company.

The first telephones to be placed in service in Canada were leased in pairs for use on private lines erected by the lessors. In fact, until 1878, when the first telephone exchange in Canada was opened at Hamilton, Ontario, this was the only means of providing telephone service to Canadians. Telephones were leased from Professor Melville Bell or his agents, and the first such instruments were leased by Mr. Bell to Prime Minister Alexander MacKenzie in 1877. The limitations of such a method soon led to the invention of the switchboard, leading to the development of the switched network, as we know it today.

The formation of the present major telephone companies in Canada began in 1880, with the establishment of The Bell Telephone Company of Canada. It set about to unify the provision of telephone service in Canada, presumably along the lines that had been followed in the U.S., although these had not assumed their final form until 1885 to 1890.

In 1880, Bell acquired the telephone licences and plant of:

- Dominion Telegraph Company of Canada
- Montreal Telegraph Co.
- The London Telegraph and Telephone Company
- The Hamilton Telephone Company
- The Canadian District Telegraph Company (Limited)
- Windsor, Ontario, telephone exchange
- Quebec telephone exchange

In acquiring the telephone operations of the telegraph companies, arrangements were made whereby telegrams could still be passed by telephone where telegraph facilities were not available. Some telephone companies still collect telegram charges, remitting to the telegraph companies.

In 1881, Bell acquired interests in all of the Canadian provinces as they exist at the present time, except Newfoundland. In British Columbia, the interest was by the exercise of licensing rights for the use of telephone rather than by the purchase of plant. An obstacle to expressing a deeper interest in British Columbia was the construction costs expected in the mountains.

A variety of circumstances resulted in Canada developing differently from the U.S. Vast distances, difficult to bridge economically, and initially impossible to bridge technically, caused the creation of many small "local" companies, sometimes in competition with The Bell Telephone Company.

In the Prairies, governments could see a real need for rural service but the costs could not be economically supported by private enterprise. As well, there was a strong sentiment among the new settlers for public or co-operative ownership of utilities and marketing services.

The result of these circumstances was that Bell sold its interests in all the provinces except Ontario and Quebec during the period 1885-1910. These interests were acquired by the provincial governments in the Prairie provinces and by investor-owned companies in the Maritimes.

It should not be assumed that the companies referred to here were the only companies existing. In most, and probably all provinces, many independent telephone companies were organized, and many still exist today. There are approximately 900 in Saskatchewan, close to 1700 in Canada. Competing telephone companies also kept appearing, and history provides much information illustrating the public need for regulated, monopolistic provision of public telephone service.

Thus, it evolved that major companies became responsible for the provision of total facilities in their areas, and these areas grew through mergers with and acquisitions of other companies. In this way, by connecting agreements with neighbouring companies, and finally through the connecting agreement of the Trans-Canada Telephone System (1931), the telephone companies met the need for wider service, culminating in complete national service with interconnections to practically all countries in the world.

The telephone utility was born in competition. The late 1880's and early 1900's saw telephone companies competing with each other. Subscriber service suffered, and it soon became obvious that the public could not be well and economically served by competing telephone companies. A statement of the time, "double bill or half service", illustrates the situation.

Competing companies could not survive. Inevitably one failed, to be bought up by the other. Competition was expressed through price cutting, which left neither company with the resources to expand and improve its service. Once one company became firmly entrenched, new competition was virtually impossible.

Thus, the public telephone business naturally became a monopoly, and public regulatory processes were developed to provide those controls that adequate protection of the public interest requires.

For somewhat similar reasons, the large telephone companies became larger. The degree of co-ordination and uniformity required to develop an efficient system led to mergers and acquisitions of non-competing companies. Small companies found it difficult to finance modernization and improvement. They were acquired by larger companies with the resources and the intent to provide modernization to meet the public need.

This process of evolution continues today because the skilled manpower combined with the financial strength of the telephone companies are necessary to meet the evolving telecommunications need of Canada.

A particular feature of the telecommunications business in Canada is the almost universal use of flat local service rates by the telephone companies. In other countries, local rates are substantially measured. Discussion of this feature of Canada telephony will be covered in Telecommission Study 7 (ab).

PART III

ORGANIZATION

CN/CP TELECOMMUNICATIONS

CN/CP Telecommunications provide throughout Canada a full range of telecommunications services, except public telephone service, in keeping with rights granted under the Canadian Pacific's charter and the Canadian National Railway Act. In this respect, the Canadian Pacific and Canadian National Railways' involvement in telecommunications differs from that of most railroads, whose primary concern is the provision of communications for railroad operations. CN/CP Telecommunications represents a joint undertaking by the telecommunications departments of the parent railroads as a telecommunications carrier.

In addition, CN Telecommunications has the exclusive responsibility for public telephone service in certain areas of Newfoundland, and of the Northwest Territories and Yukon.

As departments of Canadian Pacific and Canadian National Railways, CN/CP Telecommunications are responsible to the parent organizations for provision of telecommunications services to their customers and for the maintenance of a satisfactory level of earnings.

Within each company, the telecommunications departments are treated as separate entities. They do not carry out or arrange for their own financing for new capital, but compete with other departments within the corporate structure for capital allotments. The amount of capital made available is dependent on their earnings potential and availability of capital

from the corporate body. In practice, however, the only limiting factor is the maintenance of an adequate rate of return.

While the Canadian National and Canadian Pacific Telecommunications are integral parts of their respective rail organizations, charges for service provided to and obtained from other departments of the parent companies and company subsidiaries are assessed at commercial tariffs. Each has access to a number of corporate services for which they are billed according to use made. Such services which are available to all departments include personnel, stores, medical, accounting, finance, transportation, law, investigation and public relations.

SHARING REVENUES AND EXPENSES

Prior to 1947, Canadian National and Canadian Pacific Telecommunications operated as competing carriers. Since that time, competitive pressures from the telephone companies have caused Canadian Pacific and Canadian National to "pool" their resources and operate as a joint enterprise. "Pooling" was initially limited to private line services. The underlying principle established, at that time was that there should be equal contributions in terms of capital investments and operating costs, in return for which all revenues would be shared equally. There was, and still is, no actual inter-company accounting of operating expenses for such services, it being left to individual initiative to maintain the lowest level possible. These principles have subsequently been extended by means of a program of plant amalgamation, so that by 1974 there will be no duplication of terminal plant except in Vancouver, Winnipeg, Toronto and Montreal. This is being accomplished by the assignment of responsibility by area, with the aforementioned cities being excluded, to enable

a balancing of effort and to protect service reliability, since installations in these four locations are primary regional distribution centres. The diversity of plant at these locations minimizes the possibility of large-scale interruptions to service.

Since services are equally shared, a comprehensive set of plant records are maintained for monitoring each company's plant contributions to the pooled effort. A basic assumption is made that if the plant contribution is equal, the maintenance offered by each company will also be approximately equal. Regular reviews are made of each company's contribution and construction plans are adjusted to minimize discrepancies.

Variations of these principles have been applied in other service areas in respect to major switching and transmission systems. Agreements have been reached which provide for joint ownership of Telex and Broadband switching equipment, and microwave and coaxial cable transmission systems. The maintenance and operation of switching equipment is included in the responsibility allocations. However, maintenance and operating expenses of jointly-owned transmission systems are shared equally, to avoid disparities in cost due to geographic locations.

Similarly, area responsibilities have been assigned for the provision of Public Telegraph Service. In each area, one company is responsible for all Public Telegraph Service and, in order to avoid accounting complexities, retains all revenue originating from that location. There is no sharing of operating and delivery expenses beyond the sharing of responsibility for interconnecting lines.

ORGANIZATION

Within the pooling arrangement each company operates as a separate entity, administratively, operationally and financially. Canadian Pacific is operated from a System headquarters at Montreal, with four regional offices located at Vancouver, Winnipeg, Toronto and Montreal. Canadian National headquarters are at Toronto, with two regional offices at Toronto and Edmonton. Regional operations are further subdivided into four operating districts, with headquarters at Vancouver, Edmonton, Dawson Creek, Winnipeg in the west, and Toronto, Montreal, Moncton and St. John's in the east. Each department reports through a General Manager to its respective rail organization at an executive level. Headquarters operations are responsible for such functions as marketing, engineering, planning, personnel, system accounting and for supervision of operations. Operations are the direct responsibility of the Regional Managers and their supporting staffs.

At this time Canadian National/Canadian Pacific Telecommunications employ approximately 6,600 people, of whom approximately 15 percent perform management and supervisory functions, 12 percent are non-scheduled clerical staff and 73 percent are employed in jobs of a technical nature. All of the latter are assigned to the regions, and are members of either the Canadian Telecommunications Union or Transportation Communication Employees Union.

This organization has been the result of continuing development brought about by technological advancements in the telecommunications industry to meet the demands of the Canadian economy for new and improved

telecommunications services. Significant has been the decrease in operating personnel associated with the Public Telegraph Service. The volume of telegraph service reached a peak in 1954, and has been declining ever since at an annual average of approximately six percent, due, in part, to the increased use of line switched services. The decrease in this class of personnel has, however, been more than offset by rapid increases in technical maintenance personnel, brought about by technological advances and the introduction of new and more complex services. In fact, the number of personnel in this category has increased over a 30 year period by 25 percent. This compares favourably with increases in gross revenues, over the same period, of approximately 900 percent in that it indicates growth in technical capabilities with good control in costs, by application of modern testing and maintenance techniques and the use of automation.

Maintenance of technical competence has and will continue to be a major consideration. This competence must, of course, be complemented by a familiarity with company organization, procedures and policies. To this end, it has been and will continue to be necessary to provide comprehensive training programs. CN/CP operate continuous schools for its technical personnel, and maintain a staff whose sole responsibility is to prepare and provide courses and training information on new technologies and equipments. This has particular significance in telecommunications where, because of changing technology, it is frequently necessary to retrain senior personnel in other types of work.

Similar to most industries, the selection and development of

management supervisory personnel has become more difficult, as the pace of business has accelerated and the needs for prompt decisions to seize market opportunities have intensified. CN/CP has recognized this need with the establishment of management development courses and greater use of university training programs and industrial seminars.

A major aim in the development of CN/CP Telecommunications has been the realization of efficiencies available by joint operations. To this end, it has been necessary to eliminate duplication wherever possible, coincident with retention of management and financial identity. Wherever joint interests are best served by a common staff, joint offices have been established to administer segments of our business. Sales staffs have been amalgamated, and administration of jointly-owned switching systems is handled by one authority.

PLANNING

On the other hand, the planning for new developments and expansion programs and the financial management of operations continues to be an individual responsibility. Planning has benefited from this arrangement in realizing the best ideas generated by two independent authorities, and the ability to test the soundness of programs on a vitally interested partner. Duplication in development has been avoided by the assignment of specific programs.

In the planning area, be it in the long range or current plan stage, there are four basic facts which are given careful attention:

(a) Market Planning

A future demand for an existing service of for a potential new service must be identified by study of many factors which include historical information, various indices of industry growth, gross national product of the country, pricing strategy, life cycle analysis and demand for the service.

(b) Technological Planning

All current plans (5 years) are based on known or proven technology. Considerable time and effort is spent on a long range determination of the state of the art, to be absolutely certain that adequate technology is being used in planning for current and future installations. Work done in long range plans is much more difficult, as the state of the art is changing so rapidly that what may be a "way out" idea today may be the "in thing" 10 years hence. In fact, the long range plans are mainly guide lines for specific planning within a five year term (current).

(c) Financial Planning

Every project is examined from an economic standpoint to ensure that it will continue to produce (if expansion to an existing service) or will produce (in the case of a new service) a service at a rate which will be attractive to the user, and at the same time provide a return in both CN and CP investments which will attract the capital to carry it out.

(d) Human Resources Planning

Staff, both in relationship to quantity and training, required to carry out future plans is a very real factor to be reckoned with, before embarking on an expanded or new endeavour.

Monthly meetings are held at CN and CP senior management level at which time current and long range proposed plans are evaluated within the above four outlined categories, to determine their soundness and if they are meeting overall management objectives.

Once a program is embarked upon, regular reviews of its progress are made at management level with extensive use of C.P.M. charts (critical path method) to identify and rectify trouble areas.

CN/CP SERVICES

The present day expertise in telecommunications of Canada's two national railways, CN/CP, has been the outgrowth of the railway's basic need for communications. As the Canadian Pacific Railway's ribbon of steel first crept across Canada in the 1880's, a telegraph line followed, at first with a single conductor and then expanding to many pairs. From this small beginning of providing for railway operations, the telecommunications capabilities of both of Canada's major railroads have grown in step with Canada and have pioneered many of the telecommunications services which we have come to accept as a way of life. CN/CP Telecommunications has played important roles in Canadian economic development. Since 1911, they have been in the foreground of the wired news service (Canadian Press and later Broadcast News) - stock exchange ticker operations - commercial radio broadcasting coast to coast - air traffic controller voice network - weather map facsimile distribution network. Until the commissioning of the telephone companies' Trans-Canada Microwave System in 1958, all long distance telephone service to western Canada via a Canadian route was served over railway telegraph lines between Sudbury and Winnipeg. The first circuit in this area was

established on August 6, 1928.

In 1956, CN/CP introduced to Canadian business a world-wide Telex network, which has experienced an annual growth in Canada of 18 percent per annum. In later years, CN/CP provided some TV network facilities for the CBC. Again in 1967, CN/CP introduced an important communication service to Canadian business - Broadband service, specifically designed to handle high speed data (initially up to 50 kilo-bauds). CN/CP have also provided an integral part of the very extensive defence circuitry of the Canadian Forces. From a small beginning in 1881, with only one customer, CN/CP has grown with Canada until now, 89 years later, it is an important entity in Canada's telecommunications industry.

PART IV

ORGANIZATION

TELEPHONE INDUSTRY

There are more than 1700 telephone companies in Canada today. A customer of any one of these can be quickly connected to a telephone in either his local or any other company, both within and outside Canada.

The complex problem of interconnecting these companies to provide Canada with a system which ranks high among those of the world, could not have been solved without the highest degree of co-ordination and standardization in all phases of planning and design down through the years.

This co-operation between companies led to the establishment of formal associations of operating companies, the first of which, The Telephone Association of Canada, appeared in 1921. Its membership today includes the eight members of the Trans-Canada Telephone System listed on Page 32, in addition to the following:

edmonton telephones (City of Edmonton)

The Island Telephone Company, Ltd. (P.E.I.)

Northern Telephone Ltd. (Quebec and Ontario)

Ontario Northland Communications (Ontario)

Québec-Téléphone (Quebec)

The purpose of this organization is to facilitate a sharing of experience between companies, and the exchange of technical and operating information. An advantageous degree of uniformity among the members' practices resulting from this participation in TAC affairs contributes

greatly to their effectiveness. This is achieved through the activities of the various functional committees, composed of senior management personnel from each of the companies. TAC also sponsors Canadian representation on international telecommunications associations.

There are many smaller companies which are not members of TAC. They, too, have similar associations, with aims very similar to those of TAC. These associations include the Canadian Independent Telephone Association, Quebec Independent Telephone Association, Ontario Telephone Association and the Saskatchewan Association of Rural Telephone Companies. Liaison between these associations and TAC is maintained through contact between their member companies, and the member companies of TAC.

Of great significance to the development of telecommunications in Canada was the formation, in 1931, of the Trans-Canada Telephone System, organized to design, build and operate a Canadian continent-wide network.

Prior to its formation, Canada relied on transmission through the U.S. for most of its Trans-Canada requirements. With the advent of TCTS and the provision of completely Canadian facilities, Canada gained full control of its telecommunications network.

The Trans-Canada Telephone System's membership consists of the major telephone company in each province, representing the greatest resources and investment in toll facilities. Membership is thus related fundamentally to provincial boundaries, and hence has a definite, well-understood and permanent basis.

The members of the Trans-Canada Telephone System are:

Alberta Government Telephones

Bell Canada

British Columbia Telephone Company

Manitoba Telephone System

Maritime Telegraph and Telephone Co., Ltd.

The New Brunswick Telephone Company, Ltd.

Newfoundland Telephone Company Limited

Saskatchewan Telecommunications

- Canadian Overseas Telecommunication Corporation is an associate member of TCTS.
- Maritime Telegraph and Telephone Co., Ltd. represents the interests of The Island Telephone Company, Limited.

The Trans-Canada Telephone System is not a corporation, but an association or voluntary partnership of eight telecommunications organizations working together to provide the necessary co-ordination and integration of Canada's telecommunications services on a national basis. As partners in this nation-wide business, they provide a complete network capable of carrying a diversity of communications -- television and radio programs, data and defence communications as well as regular traffic from coast to coast.

The System is directed by a Board of Management composed of Directors representing all member companies. The Board of Management meets frequently and all decisions are based on unanimous agreement. Experience

has shown that this is the best way to determine ways and means of meeting objectives of all provinces, and with this the objectives of the nation. The requirement for unanimity makes it impossible for a majority to impose its will.

The Board is supported by inter-member operational and administrative committees that plan and co-ordinate the carrying out of the various programs of the System in its national telecommunications activities.

All members have a dual role: to provide good quality service within the territories they serve and to work together to provide nation-wide facilities and services.

Achievement of this objective requires the establishment of design standards and common operating procedures. This calls for co-operation and planning of high order.

TCTS is a unique organization in that it combines in its membership, companies of different types of ownership, whose activities are affected by several different regulatory agencies. The three Prairie companies are provincially-owned Crown corporations, while the rest are investor-owned. In other countries, ownership is vested primarily with the central government or, as in the U.S., with investor-owned enterprises which have developed the telephone industry to its present level of efficiency.

One important factor in the development of communications has been the close association between Canada and the U.S. This association

was of great advantage in the early development of the Canadian system -- and continues to be.

Because of the size of the American operations, research and development results far beyond the scale that Canada itself could afford to produce are made available through special service agreements.

Service agreements have contributed greatly to the development of the Canadian system. Principal among them are the agreements of the members of TCTS, (except British Columbia Telephone Company), with Bell Canada; between Bell Canada and A.T. & T.; and between B.C. Tel. and General Telephone and Electronics.

The agreements permit the flow into Canada of technical and operating information produced by the vast resources of A.T. & T. and General Telephone, supplementing our own capability. Through member relations with independents, the entire Canadian industry benefits.

Joint courses, conferences and seminars are conducted, which enhance the capabilities of telephone people in all aspects of the business.

The individual members of TCTS accept the responsibility to co-ordinate with all telephone companies in the provinces in which the members operate, with the objective of ensuring that the total public need for service is met to the maximum degree possible. Member companies work closely with these companies, providing training courses, technical assistance, and System information as required. Each member, therefore, recognizes a dual responsibility, both to these connecting telephone companies as well as to the other members of TCTS.

CONSTRUCTION PROGRAM

Probable no single effort better illustrates the high degree of coordination and cooperation that characterizes the TCTS operation than the annual construction programs. The TCTS program is really the sum of parts of each member's construction program, although it can be said, with equal strength, that each member's program includes his contribution to the TCTS network.

As each member prepares his construction program he considers many factors and conditions. The single objective is to provide, improve and expand the service offerings in his operating territory in both intra-company and Trans-Canada services, so that his system will continue to fill its role as a vital part of the total national system.

During the past ten to fifteen years particularly, there have been tremendous increase in the demand for basic telephone and other telecommunications services. This has been coupled with a trememdous surge in the volume of traffic handled, resulting in a significant increase in the size and cost of construction programs of all the Trans-Canada companies; all in an era of rapidly rising costs.

For the member companies of TCTS alone it is estimated that in the next five years, essential construction will entail expenditure of around $4 billion, about as much as has been spent in the last ten years.

Because of the nature of their business, the telephone companies have much less choice in the size and timing of their expansion program than

most industries enjoy. A continuous program of construction must be undertaken to ensure the availability of facilities -- to the extent possible, considering economic and financial constraints -- to meet consumer needs.

As an essential preliminary to the determination of expenditures required to provide facilities for growth, a forecast of the probable demand for services must be made.

A great deal of attention is given to forecasting demands for telephone and other telecommunications services. The changing environment in each section of each telephone exchange area is continually analyzed, to provide forecasts of future requirements.

PLANNING

Planning for the network is structured in two phases. First, planning is carried out within the framework of fundamental plans which are broad, long-range 15 to 25 year views of the future in terms of growth, environment and technology. These are intended to be guides rather than specific courses of action, to help prepare for the future in an economic and orderly fashion, and to visualize where innovation or new technology may be used to advantage.

The second phase concerns current plans where the focus is on the next five to seven years, and are considerably more detailed. This stage of planning is based on known technology.

Planning influences financial and manpower programs, and research and development recommendations, and it is important to communications equipment manufacturers in forecasting future production loads.

The nature of the communications business dictates that all additions to the network be compatible with existing plant. Furthermore, these additions must incorporate the latest technical advances to ensure meeting service requirements which are becoming more critical as to quality, and are increasing in variety. Additions are planned in the most economical manner, having due regard for both initial and continuing costs.

The effective implementation of construction programs requires continuous review and revision of estimates of dollar and material requirements. At regular intervals each year, construction programs are reviewed and analyzed. Analysis identifies projects which must proceed so that growth in service requirements will be met as forecast, and progress toward essential modernization objectives maintained.

In implementing the program, due consideration is given to service, financial return and manufacturers' production, as well as to financial and manpower resources. The engineering of each project includes an economic comparison of possible plans to select the optimum course.

The total construction expenditures are affected by four major factors:

1. Replacement and movement of plant in service;

2. Growth in demand for present service offerings;
3. Innovation and modernization of services and equipment;
4. Resources.

1. Replacement and Movement of Plant in Service

Expenditures in this category are required because of customer movement, public improvement projects, and for replacement of plant either damaged by storms or not economically maintainable.

The expenditures do not increase revenues, but are essential to maintaining service.

2. Growth in Demand for Present Service Offerings

The growth in the number of telephones in service in Canada has been dramatic during the last ten years; from 1959 to 1969 it was over 70 percent.

At the same time, the calling rate has likewise increased, to the point where Canadians are among the most talkative people in the world, with an average of nearly 700 telephone calls per person per year. This growth in the calling rate has required great additional capacity in both switching equipment and transmission network facilities.

Also included in the growth category are expenditures required to promote continuity of service and survivability of plant. This reliability is expected by Canadian telephone customers and must be maintained.

3. Innovation and Modernization

Telephone companies must ensure that planning done today will meet the needs of the future as public expectations rise, and technology advances. Inability of telecommunications services to cope with the traffic volumes expected in the future would have a serious impact on the Canadian economy. It is therefore essential that the network be able, through continuing modernization, to meet future demands.

This important portion of the construction program makes provision for all forms of innovation and modernization in switching, transmission, and terminal apparatus to meet emerging requirements being generated by such developments as computerized information banks, computer to computer transfer of information, visual services, in addition to the continuing modernization of public telephone service.

The importance of organizational structure is promoting innovation in the telecommunications industry is discussed in Appendix 1 to this Telecommission Study.

4. Resources

The ability to carry out construction programs depends on the availability of all necessary resources: materials, manpower and money. Capital resources are particularly vital, and the lack of sufficient capital would seriously impair the program through inadequate provision of facilities and possible deferment of new construction designed provide facilities required for the needs of the future.

The availability and cost of all three categories of resources are significant controlling factors in construction programs, particularly in the current era of inflationary trends.

REVENUE SETTLEMENT

Because of the variety of services provided jointly by the many telephone companies in Canada and the importance of the revenue derived, revenue settlement is a significant facet of the total operation. Together with the technical factors of co-ordination, integration and compatibility, revenue settlement is vital to the task of welding the close to 1700 Canadian telephone companies into one efficient system.

The Trans-Canada Telephone System divides all System revenues among its members. In turn, the members of TCTS arrange settlements with most Canadian independent telephone companies. The purpose of these settlements is to ensure that the independent companies as well as the members receive a fair share of the revenues to enable them to participate in the provision of complete national service. These settlement arrangements are arrived at through discussion and what is, in fact, a bargaining process.

Revenues collected by one company for service provided in conjunction with one or more other companies are naturally subject to settlement.

There are five categories of toll message settlements:

Independent Company Settlement: covering all toll traffic exchanged between an independent company and a connecting TCTS member company,

including all calls which originate or terminate outside that member's operating territory.

Adjacent Member Settlement: covering all toll traffic exchanged between adjacent TCTS members, including that originating and terminating in their independents' territories.

Trans-Canada Settlement: covering all traffic involving the territories of three or more TCTS members, including independents, the Canadian portion of Canada-U.S. and domestic carrier portion of overseas toll traffic.

Canada-U.S. Settlement: covering Canada-U.S. toll traffic. Its purpose is to determine the Canadian and U.S. revenue shares, the Canadian part being settled among Canadian participants through the Trans-Canada and independent company settlements.

Overseas Settlement: covering the domestic carriers' portion of Canadian toll traffic with overseas points. Like the Canada-U.S. settlement, it determines the share to be distributed through Trans-Canada and independent settlements.

Settlement categories for private line services are very similar to those for message toll. The main difference is that any Canada-U.S. private line service involving only one Canadian company is settled directly by that company with the U.S. company concerned. All Trans-Canada private line revenues are combined with message toll revenues in the Trans-Canada settlement category.

Thus, the total Trans-Canada revenue settlement includes the revenues from all defined Trans-Canada categories including Canada - U.S. plus the Trans-Canada portion of Overseas revenues.

An important objective of a settlement plan is to produce mutually acceptable results to the participating companies. It is more important that the type of settlement achieve this objective than that it conform to any standard pattern. Thus, the various members of the industry have chosen the type that best meets the needs of a particular relationship.

There are a variety of plans to distribute revenues. By far the greatest sum of money is settled under what is known as the Full Division Plan of Settlement. This type of plan is used by TCTS members for Trans-Canada and most of their Adjacent Member settlements.

A large number of settlements are made on a Commission and Prorate basis. Many variations are used for settlements between TCTS members and their independents. There are also a few settlements related to rate schedules.

Differing environmental situations have resulted in modifications so that many specific settlements vary from one another in minor ways to achieve the desired acceptability.

Because of the significance of the Full Division Plan type settlement it is considered that a general description would be of value.

While the basic principles of Full Division Plans of Settlement are always the same the procedures permit a wide variety of weighting factors

and arbitrary assignments to be used, in order that bargaining parties may arrive at mutually acceptable solutions. Very few, if any, Full Division Settlement Plans are identical.

Under the Full Division Plan, the revenues to be settled are pooled. Basically each member receives from the pool an amount equal to the expenses it assigned to provide the revenue generating services. The balance of the pooled revenues is distributed to each participant on the basis of his proportinate participation in the provision of the service. The participant's contribution is normally measured in terms of his assigned plant investment.

Each participant therefore determines:

a. Originated revenues for distribution after settlement with independents
b. Assigned expenses
c. Assigned Plant Investment

The amounts of "assigned expenses" and "assigned plant investment" are determined by application of detailed, uniform procedures, agreed to by the participants.

In the mechanics of the process, the participant's total plant investment is separated into theoretical categories - exchange and inter-exchange. A portion of each category is assigned to each settlement by use factors. The portion assigned is determined by agreed methods to measure proportinate participation in that settlement by agreed measurement units.

Similarly, "expense" participation is determined for each settlement by analysis and correlation of accounting and use data. This measurement also assists in recognizing the impact of variations in labour rates, geographic factors, etc.

The pooled revenues are then distributed in accordance with the principles described above.

"Assigned investment" and "assigned expense" allocations as carried out by TCTS for revenue settlement purposes do not determine rates of return when related to revenue. They are only used as a measure of the proportionate participation of the members. They are not a measure of actual investment and expenses in a given service.

Because of the fact that average use factors and ratios are applied to assign broad categories of exchange and interexchange book costs and expenses to the various settlements, any similarity between assigned investment and expense dollars and actual investment and expense dollars is destroyed.

The procedures of the Full Division Plan of settlement are complex. There is a high degree of uniformity required in the total involvement. It is essential that there be uniform accounting, uniform settlement study procedures and reasonable uniform characteristics, such as scope of service offering and rates.

In summary, this overall chain of settlements has been a vital part -- just as modernization, innovation and response to public need have been -- in developing the Canadian telecommunications network.

PART V

TELECOMMUNICATIONS: CANADA AND OTHER COUNTRIES

Comparisons of national telecommunications systems are extremely difficult, as the variables and combinations of them, which affect the development of a system are almost unlimited.

The following table indicates the degree of penetration of the market in telephone and record message business, as of January 1, 1969.

Country	Telephones Per 10,000 pop.	TWX-Telex Customers Per 10,000 pop.
Switzerland	4,342	15.46
West Germany	1,865	11.99
Austria	1,688	11.40
Norway	2,702	7.74
Sweden	5,176	N/A
U.K.	2,326	5.15
France	1,498	3.15
U.S.	5,402	4.15
Canada	4,212	10.40

Canadians travelling abroad tend to measure the standard of service in other countries by the standard they are accustomed to at home. This is natural, but hardly valid. The standard of service provided in any nation should be measured by that nation's need, its ability to pay and many other factors. Service that Canadians would not consider good may well be adequate for another country.

Comparing service requires consideration of many factors and, in fact, pure conclusions are next to impossible to draw. It is equally difficult to compare rates, but no comparison is really valid unless it relates to the unmeasurable -- the service for which payment is made.

One measurement, for example, is that it takes two hours of work for a Canadian telephone customer with average income to earn the cost of a month's individual line residence service. In the United States, the figure is 2 hrs. 10 mins.; in London, England, 4½ hrs. (double the amount), and in Paris, France, 16 hrs. or 8 times the cost in Canada.

However, the proportion of the gross national product of these nations which is represented by the value of telecommunications services, is not readily available and would require considerable research to develop.

The way of life has an effect on telecommunications needs. Where a population moves on foot or on bicycles, they are less likely to demand telephone service like that of Canada and the U.S., and do not appear to need the standard offered on this continent.

National policy is a factor, particularly where postal service and telecommunications are provided by the same department of government. This is fairly common in European countries. It then becomes a question of which method of communication national policy emphasizes: postal, telegraph, telephone, Telex-TWX.

Pricing policy is a large factor. European telephone systems use measured rates, the U.S. is heavily "measured rate", Canada is flat rate. It is generally accepted that measured rates depress demand for service, particularly in nations of lower standards of living. Hence, measured service reduces use of telecommunications more in European nations than it does in the U.S.

Financing is a major consideration. In Canada and the U.S., telecommunications companies rely on the external financial market to a substantial degree for their capital requirements. In Sweden, most of the Telecommunications Administration's financing is from its own internal sources, with some government financing involved. In other European countries, the telecommunications capital budgets are subject to the availability of government financing and, presumably, are considered in light of priorities with other government projects in the allocation of funds.

Integration of manufacturing, research and development functions with the operating companies seems to be a major factor in the total national development. Whether it is a cause or effect is not important because it is an essential, regardless. In the United States, this integration is achieved by General Telephone and Electronics Corporation for their group of companies and by A.T. & T. with Bell System operating companies, Western Electric and Bell Labs. In Canada, the G.T. & E. has Lenkurt Electric Company of Canada Limited and Automatic Electric (Canada) as manufacturing and R&D subsidiaries of G.T. & E. Bell Canada has the manufacturing and R&D facilities of Northern Electric.

The topic of innovation and corporate integration in Canadian telecommunications is discussed more fully in Appendix I to this report.

Thus, it can be said that the two countries having what is considered to be the best telecommunications service also have the highest degree of integration of manufacturing, R&D and operations.

In Sweden, the Telecommunications Administration carries on operations, manufacturing and R&D within its own organization. In recent years, it has joined forces with the L.M. Ericsson Company of Sweden to pool the resources of both in the development of electronic switching equipment.

The Administration usually manufactures all customer equipment, switching equipment and private branch exchange equipment from its own designs, but it co-operates with outside manufacturers of transmission equipment to supply a large part of its requirements.

Britain has recently re-organized its Post Office to form a Post Office Corporation with a Board largely drawn from outside the public service. A very strong executive team has been assembled to revitalize the General Post Office. Within the Post Office Corporation, there are major divisions for telecommunications and postal service.

Under the old system, equipment was manufactured for the Post Office by selected manufacturers under bulk supply agreements. This system was cumbersome, as every little specification was tied down to the most minute detail by the Post Office, leaving no room for innovation on the part of the manufacturers. The Post Office, however, has its own R&D facilities, and under the new system, joint planning by the Post Office Corporation and industry will take place through an advisory group on telecommunications systems definitions. The Post Office Corporation will then purchase equipment through competitive bidding using specifications developed by the advisory group. Specifications will be more detailed for interfaces than they are currently. Very ambitious plans for improvement have been outlined in a government white paper, published in 1969.

In France, a single ministry administers the closely linked activities of post, telecommunications and banking. The telecommunications organization is completely dependent on outside suppliers for all its supplies.

Existing facilities are overloaded and there is a long waiting period for new services. The ministry is facing a serious situation in its efforts to overcome the problems.

By all appraisal standards, it is generally agreed that the Canadian systems with their well integrated R&D, manufacturing and operating functions provide excellent service. In Great Britain and France, there is a much lesser degree of integration and these systems are not considered comparable to those in Canada, the United States and Sweden.

The factors of service, consumer needs and market penetration are related. They are, in themselves, a combined factor determining the degree of public acceptance of telecommunications service. If the service does not meet the public's need, the public does not buy it and does not use it. An example can be found in France, where there is a recorded backlog of 350,000 applicants for telephone service, but it is estimated that the actual backlog is really about 2.5 million, because many potential customers do not apply due to the delay in obtaining service.

As France improves the technical standard of existing service and expands its network to meet identified needs, a new flood of demand will appear which in turn will create further congestion. Until these demands are met, the quality of service will not substantially improve.

There is an old adage in the telecommunications business, "service sells service" and, until the service "sold" is provided on demand and is technically good, the public need is not being adequately met.

There are four ways by which people communicate information to one another: face to face, mail, telegraph and telephone. The last three are really monopolies, but it is only in Canada and the U.S., of the countries looked at, that they are provided by different organizations.

In Canada, neither postal nor telegraph revenues are considered when planning telecommunications and designing long distance message rates; in Great Britain they could well be a major factor.

A distinct advantage contributing to the high standard of service between Canada and the U.S., is that Canadian carriers are completely integrated in a total system design with their U.S. counterparts. The resulting high degree of uniformity of service facilitates the ease by which the public can use the service.

It has already been pointed out that service in other countries should not be measured by Canadian and U.S. standards but by the needs of the countries concerned. Canadians must judge their own service by how well it meets their needs, and their own carriers by how well they perform in anticipating and serving the total public need. Canada needs constantly improving service, regardless of what kind the rest of the world has, and its carriers intend to provide this.

PART VI

CANADIAN TELECOMMUNICATIONS INDUSTRY:

GROWING WITH CANADA

The development to date of the Canadian telecommunications industry has been achieved, for the most part, through the efforts of the communications carriers. In the industry's opinion, the public need for service has been met and will continue to be met in the future.

The Canadian telecommunications industry has approximately seven billion dollars invested in facilities which, in recent years, have been increasing at about 10 per cent per annum. Demand has been adequately forecast and met, as evidenced by the short lead time required to provide a service once the order has been expressed. This is particularly noteworthy, in view of the long lead times required to produce backbone networks.

During the last fifteen years:

- 29,000 route miles of microwave systems have been built;
- 5.3 million telephones have been added;
- 23,500 Telex-TWX installations have been made;
- Direct Distance Dialing has been provided.

To meet these tremendous growth requirements, the Canadian telecommunications industry has been a leader in innovation in Canada. The industry continually carries out research to determine what the user wants.

The public telecommunications systems have been growing ever since the early beginning of the industry. While the systems are constantly being improved and expanded, it is always necessary to ensure that new facilities will be able to work with the existing facilities and be compatible with existing network parameters. It is thus no accident that the "total system concept" in technological planning originated with the telecommunications industry.

The "total system concept" requires the study of many factors involved in the decision to incorporate new facilities in the system. These include technical and operating characteristics, market and economic considerations, compatibility requirements, optimum time schedule and appraisal of alternate possibilities.

Frequently a considerable amount of R&D and engineering information is required to permit proper appraisal of all the factors and to satisfy demands.

Further planning is required on the part of the operating companies and the manufacturers to co-ordinate the various activities such as production, installation, training of personnel, financial planning, establishment of maintenance facilities and market introduction.

As will be evident from the above, innovation in the tele-communication industry is a rather complex process which involves close integration of efforts between the various disciplines in the operating companies' and the manufacturers' organizations. Quite often, new industry projects also need to be planned on a national basis requiring system co-ordination.

The vital role of management in the operating companies, as instigators of innovation, needs to be emphasized. Planning of new facilities and the introduction of new services must necessarily be done well in advance of current market requirements. While comprehensive and thorough planning enables management to make decisions with a greater degree of certainty, there is no such thing as an infallible way of judging market conditions, technological trends, and the many other factors influencing the economic outlook for the telecommunications industry. Therefore, a fairly high degree of risk is associated with many of these management decisions.

In recent years the Canadian R&D capability has been greatly strengthened by close co-operation among telecommunications operating companies, manufacturers and R&D organizations, and also by federal government assistance programs. As a result, Canadian technological capability in the telecommunication field has been much improved and this progress is continuing. More than any other Canadian industry, the Canadian telecommunications industry has been conscious of the need to innovate in order to keep abreast of new service demands, and to continue to provide Canada with one of the world's best telecommunications systems.

It is of tremendous importance to the industry to possess a high level of technical competence, and this level has been raised through the establishment of strong Canadian R&D laboratories. This indigenous R&D effort is vital to support Canadian manufacturers of telecommunications equipment, and the Canadian public telecommunications carriers are justly proud of the fact that nearly all the equipment used in their networks is of Canadian manufacture.

Innovation is discussed in Appendix I to this study and in Telecommission Study 4(a) on the Future of Technology. Major new projects will make tremendous demands on the industry in the coming years but, on the basis of the past performance and the well trained and experienced personnel, there is every reason to feel confident that the Canadian telecommunications operating industry, R&D, and the manufacturing industry will be able to cope with the new requirements, expanded demands for service, and new sophisticated technology.

The great growth of the last two decades has witnessed significant innovations in telecommunications technology. Some highlights of the industry's development in this period are the introduction of:

- Telex, by CN/CP Telecommunications
- the Trans-Canada Telephone System coast-to-coast microwave system
- network television service throughout the nation
- TWX, by T.C.T.S.
- Direct Distance Dialing
- the CN/CP Transcontinental microwave system
- Touch-Tone service
- a computer based store and forward service by CN/CP Telecommunications
- electronic switching
- Broadband Exchange Service, by CN/CP Telecommunications
- Message Switching Data Service, by T.C.T.S.
- MULTICOM Service, by T.C.T.S.

These achievements have made available to Canadians, at just and reasonable rates, the complete spectrum of telecommunications services. Included among them are the following, more common services:

- Public Telephone Service The telephone customers of Canada are served by an extremely efficient system. The operations of almost 1700 companies are integrated so that all customers of all companies can achieve fast connection with each other and customers in other countries. As an illustration, Canadians placed over 432 million long distance calls in 1969, up 11.1% over 1968.

Over 98% of telephones have automatic dial or Touch-Tone service. Direct Distance Dialing was introduced in Canada in 1956, as a result of extensive studies begun in 1953. These were actually joint studies involving Canada and the United States since it was obvious that the DDD networks of both nations should be integrated.

The conversion to DDD required the close examination of practically every part of the telephone industry's operation, from billing to transmission. Each customer in North America was assigned a unique 10-digit telephone number, toll routes were re-arranged, computer type switching units were installed, additional toll circuits were built, all according to plan and co-ordinated among the companies involved.

Today, well over 90 per cent of Canada's telephones can dial directly to almost 120,000,000 telephones in Canada and the U.S.

These achievements have come about while the rate structure is one of the lowest in the world. Indeed, the Canadian industry has

reduced long distance rates over the years. A three minute station night call, Halifax to Vancouver, cost $2.80 in 1960 and $1.95 today; $1.00 if placed after midnight.

- Public Telegraph Service The telegraph service, which was the most important provided by CN/CP, grew steadily, reaching a peak during the year 1954. Since then, there has been a reduction in the number of telegrams handled, resulting probably from the many more sophisticated services that are available to the public today. At the present time, this business represents about 15 percent of the CN/CP's overall business.

The problem of picking up and delivering the telegram continues to remain the most difficult to solve. We can cross the continent with a message in a few seconds, but delivery to the customer takes the bulk of the time. Improvement has been made in this area, and such media as the telephone, facsimile and Telex have largely replaced the messenger boy.

- Switched Teletype Service

Telex - Data Telex

Telex is a relatively new communications service, inaugurated in Canada during the year 1956. It is basically an automatic system for the interconnection of teletypes by dialing. Today there are more than 20,000 customers using Telex in Canada and about 350,000 throughout the world. Telex operates at a speed of 66 words per minute in the five-level teletype code and Data Telex operates in the eight-level code at 100 words per minute. Two hundred and seventy-five customers are now using Data Telex.

TWX

TWX service was introduced to Canada in 1962. It operates in

the eight-level code, at a speed of 100 words per minute, providing switched record service and some types of data transmission. Access to the network is available at virtually every point in Canada reached by the telephone companies' network.

TWX is interconnected for international service to the European Telex network and the TWX network in the U.S. There are approximately 3,400 TWX customers in Canada.

- Private Line Service These services are provided in three types:

Voice - such as commercial voice, CBC radio network service and service to private broadcasters, both AM and high quality 15 KHz FM service.

Video - including the CBC English and French and CTV networks with colour capacity.

Digital - Many telecommunications customers have requirements of such proportions that their need can best be met by a digital service, custom built to their particular needs. These include stock brokers, computer customers, facsimile users and many other varied requirements.

- Private Switched Networks These networks meet the needs of many customers for special services. Included among them are:

  - the collection and dissemination of news in both record and voice forms.
  - facsimile transmission in the news field and in the law enforcement field.

- the transmission of stock quotations among members of broker associations.
- the particular telecommunications needs of the Canadian Forces.

Several other Telecommission Studies on the Future of Technology, The Wired City, and on Computers discuss the tremendous scope for future innovation.

This is an era of constant change -- in our institutions, in man's attitudes towards his environment, in governments, in social and economic systems and in man himself. There are no hard and fast rules for charting new communications frontiers to meet the needs of the coming society, and it is imperative that we consider all the questions objectively. We are going to be faced with a challenge such as we have not experienced in our history, and we are prepared for it.

CN/CP Telecommunications
Trans-Canada Telephone System
The Telephone Association of Canada

July 1970

LIST OF APPENDICES

INDEX TO APPENDIX 1

THE NEED FOR INNOVATION IN TECHNOLOGY

APPENDIX 1

THE IMPORTANCE OF ORGANIZATIONAL STRUCTURE IN PROMOTING INNOVATION IN THE TELECOMMUNICATIONS INDUSTRY

THE NEED FOR INNOVATION IN TECHNOLOGY

GENERAL

The need for innovation in the Canadian telecommunications carrier industry must be seen against the background of the central role of this industry in our society, its future role, and the economic and social environment of the industry. The broad term "innovation" is used here to signify the whole process of introducing new technology. It includes research and development, engineering of manufacture, market introduction and other essential steps.

The Canadian telecommunications carrier industry provides the vital information highways linking the various parts of our far-flung country together, enabling people to communicate with people, machines with machines, and broadcasters to interconnect their program studios, broadcasting stations, and other facilities to reach a national audience.

The public telephone network which forms the largest and most highly developed part of the Canadian telecommunications network is distinctly Canadian, yet it is fully integrated with the North-American Direct Distance Dialling (DDD) Network allowing Canadian telephone subscribers to dial upwards of 100 million other subscribers without operator assistance. By any comparative standard the Trans-Canada Telephone System provides service of high quality at reasonable rates. The present network facilities are flexible, providing a wide range of services from the conveyance of television signals to wide and narrow band data services, yet it is obvious that the rapidly rising requirement for data communications, pending service offerings such as videophones, and a host

of other service requirements, many of which have hardly been thought of today, will impose heavy demands on the industry and lead to a more rapid rate of innovation and increased demands for sophisticated technology.

The Canadian telecommunication carrier industry, besides having a very high degree of Canadian ownership, has also traditionally obtained most of its technical facilities from domestic manufacturers. It is a very capital-intensive industry making heavy demands on the Canadian financial resources but has also contributed very substantially to the growth of Canadian manufacturing industry and other industries supplying the telecommunications carriers. For many years most of the telecommunication equipment manufactured in Canada was of foreign design but increasingly Canadian manufacturers of telecommunications equipment have developed their own designs and are rapidly increasing their R&D capability to support their own manufacturing operations.

The market for Canadian telecommunication equipment is largely dependent on the spending on technical equipment and supplies by the telecommunications carriers, although export sales are becoming increasingly important in some sectors.

In a modern technological industry it is not feasible to plan the various steps in an innovative cycle in isolation. Thus the planning of the telecommunications carriers will largely determine the size of the accessible market, the type of equipment required, and the various technical requirements to be met. The expected sales of new types of equipment will in turn determine how much R&D it is possible to justify on economic grounds on particular classes of technology and equipment. Futhermore, advance

knowledge of the plans of the telcommunications carriers for the introduction of new equipment is necessary to allow sufficient lead time for industry to develop the kind of hardware needed at the time it is needed. Current experience appears to be that R&D expenditure in the order of 8 to 10 percent of total product sales is required to keep pace with the rapid advances in technology and in the resultant requirements of the public as identified by the telecommunication common carriers.

During 1970 the Canadian telecommunication carriers will spend about 700 million dollars on new construction and also very considerable sums on maintenance and supplies. The construction budgets of the various telecommunication carriers are at the present time very restrained due to the rigid economic climate and should probably have been considerably high to achieve an optimum rate of growth and modernization.

Future projections are always uncertain but it is expected that the total value of telecommunication plant of the TCTS companies will rise from $6.5 billion in 1970 to $17 billion by 1980 and $42 billion by 1990.* This will call for a tremendous amount of new equipment and it is of paramount importance to the telecommunications manufacturing industry that the bulk of this investment in new plant be spent on equipment of Canadian design and manufacture. Very directly therefore the amount of sales of equipment to the Canadian telecommunication carriers will determine in very large measure the financial health of the manufacturing industry and the

---

* This estimate was developed by the TCTS companies and is quoted from Telecommission Study 4(a) - The Future of Technology.

amounts this industry can afford to spend on R&D. Conversely, unless a very much enlarged R&D effort is undertaken by Canadian manufacturers of equipment for the telecommunication carrier companies, it will be necessary to rely much too heavily on imported designs and this may indeed make it impossible to satisfy the need for technically sophisticated equipment from Canadian manufacturing sources.

In considering the need for R&D in the telecommunication field it should also be emphasized that a host of new input/output devices, business machines, computer terminals, etc. will increasingly be connected with the telecommunication carrier network. Most of these devices will probably be owned by telephone customers, and this class of equipment will probably call for a very considerable R&D effort if Canadian manufacturing industry is to compete in this sector of the market.

The very central importance of electronic technology to any industrialized nation is now becoming generally recognized. In particular it may be said that Servan-Schreiber's book, "The American Challenge", in which he probes the reasons for American technological superiority and American takeover of many European industries, has proved important in focussing attention on these problems. Servan-Schreiber points out that U.S. investment in Europe is concentrated in the high-technology growth industries and that 90% of this investment is financed from European sources. After enumerating the inroads made by U.S. industry in European sophisticated electronic fields such as computers and microcircuits, he goes on to say:

> "These figures are important to keep in mind, for electronics is not an ordinary industry: it is the base upon which the next stage in industrial - and cultural - development depends. In the nineteenth century the first industrial revolution replaced manual labor by machines. We are now living in the second industrial revolution, and every year we are replacing the labor of human brains by a new kind of machine - computers.
>
> A country which has to buy most of its electronic equipment abroad will be in a condition of inferiority similar to that of nations in the last century which were incapable of industrializing. Despite their brilliant past, these nations remained outside of the mainstream of civilization. If Europe continues to lag behind in electronics, she could cease to be included among the advanced areas of civilization within a single generation."

A second quote from "The American Challenge" would appear of interest:

> "During the past ten years, from the end of the cold war and the launching of the first Sputnik, American power has made an unprecendented leap forward. It has undergone a violent and productive internal revolution. Technological innovation has now become the basic objective of economic policy. In America today the government official, the industrial manager, the economics professor, the engineer, and the scientist have joined forces to develop coordinated techniques for integrating factors of production. These techniques have stimulated what amounts to a permanent industrial revolution."

The above quotes are felt to be equally applicable to our Canadian situation and much of the thrust in our efforts to enhance the level of technological knowledge and skill in Canadian industry should be aimed at the electronic field.

The Science Council of Canada has come out strongly in favour of putting most of the emphasis on "mission oriented R&D", in other words R&D performed in support of a particular program of innovation. This view is strongly shared by the telecommunication carriers. It should be remembered

that the "total systems concept" originated in the telecommunication industry as a method for dealing with many complex factors in the planning and engineering of telecommunications systems. Under this concept the problems of technology requiring solution as part of the development of any particular system may be defined and specifically directed R&D may be concentrated on main areas. This subject will be dealth with more fully in a later section of this report.

SPECIAL CANADIAN REQUIREMENTS

The importance of the Canadian telecommunication network is such that the very functioning of our national institutions, business, news media, and cultural activities are highly dependent on the reliable availability of these services. In a world of changing military commitments, uncertain peace, and internal upheavals in many countries it would be dangerous for the Canadian telecommunication carriers to be too highly dependent on foreign suppliers. This is particularly true of our basic telecommunication services both locally and as regards toll facilities. On the other hand Canada will never be entirely selfsufficient - nor will any other developed nation, nor is it desirable to be so. This need for reliable sources of supply goes further than a mere need to assure a continued supply of equipment and parts used in the network. Today there is a growing need for knowledgeable technical back-up from industry to the service industries as equipment is becoming steadily more sophisticated. It is often not sufficient that such back-up be provided by the manufacturing plant as it is frequently necessary to know the design intent of a particular piece of equipment - knowledge which can normally only be supplied by the development laboratories responsible for the original design.

So much has been written lately on the subject of innovation that it would appear largely superfluous to repeat these arguments here. A wealth of material on this subject has been presented to the Senate Committee on Science Policy during their current hearings. In the Fifth Annual Review of The Economic Council of Canada which dealt with "Science, Technology and the Economy", a useful definition of the relationship between R&D and innovation was given:

> "While R&D is concerned essentially with invention - with the conception of an idea, and the initial development of the idea - innovation is concerned with the crucial role of entrepreneurial decision-making and risk-taking in the "follow-through" process, which involves the coupling of the initial idea of the results of R&D with engineering, design, financing, tooling-up, production and marketing. <u>Thus, R&D by itself may add nothing to economic growth. It is the innovation process - beginning when management decides to move from R&D into engineering, design and all of the succeeding stages - which brings new products, processes and services into use, and which contributes to growth</u>. A recent U.S. study sets out some "rule of thumb" figures for the distribution of costs in the successful development of certain products in that country:

Research - Advanced Development - Basic Invention	5-10 per cent
Engineering and Designing the Product	10-20 per cent
Tooling - Manufacturing Engineering (Getting ready for manufacture)	40-60 per cent
Manufacturing Start-Up Expenses	5-15 per cent
Marketing Start-Up Expenses	10-25 per cent

> If innovative activity is to be stimulated and encouraged, both public and private efforts must be directed over a much broader range of effort than R&D. There is danger that policy-makers will concentrate on support of R&D, leaving the rest of the process to take care of itself."

The Canadian telecommunications carriers carry out very extensive planning activities, combining studies of technology, traffic growth, changing population patterns, ecology, industrial and business

development, etc. in order to anticipate the requirement for new services, changes to existing services, network extension and modernization, expansion of services, introduction of new concepts of service and operation and so forth. Out of this mass of planning data emerge short term and long term plans for expansion of services, construction of new plant, and a time table for these various steps. The details of this planning process may differ somewhat within the industry but the basic steps are the same. A very important part of this planning is the technical specification of new equipment, and the overall planning of new systems. Due to the rapid advance of new technology such plans are best developed in cooperation with the manufacturing companies, particularly with the System Engineering Department of the R&D arm of the manufacturer. If any new system is to be developed in Canada, it is essential that the manufacturing companies know 5 to 2 years in advance of the requirements of the carrier companies and that extensive cooperation takes place to develop specifications, cost estimates, delivery schedules, plans for field testing and system implementation. In the case of major systems, such as e.g. the introduction of an electronic stored program switching machine, the cost of the R&D itself is extremely high and a tremendous amount of planning must be undertaken to ensure the smooth change-over to the new facility. While the risk element is correspondingly less for other products requiring less R&D or less investment in manufacturing plant it is nevertheless extremely hazardous for a manufacturer to develop new equipment without close contact with the carrier industry.

In Canada climatic and geographical conditions sometimes impose special demands on equipment performance. Thus it is important that

amplifiers and repeaters which are often exposed to extreme cold, be especially designed to provide proper temperature compensation at all times. A special requirement exists in Canada for small and economical switching machines for use in our smaller communities. Another example is the need for an economical satellite ground station for the reception of TV only, yet sturdy enough to withstand the very high wind velocities and heavy ice loading sometimes encountered in the Canadian North. The industry requirements are not always this unique to Canada as most of our equipment is built to international or North-American standards, but here it is important to assess those areas where the Canadian market plus export potential is of sufficient size to justify an indigenous design effort and those features which would make the equipment particularly suitable for Canadian conditions.

CANADIAN INDUSTRY ORGANIZATION FOR ENCOURAGING INNOVATION

In a world of rapidly advancing technological knowledge the competitive pressure on all industries is mounting. In advanced fields of technology such as in electronics technological excellence is indeed a very saleable product and very often more important than low price in securing sales. It is becoming very important for electronic manufacturing companies to produce the right product at the right time and this normally implies that to keep up with the demands of a sophisticated market a successful company must have the capability within its own organization to perform market analysis and R&D or must have direct and complete access to such knowledge from a closely associated organization. There is normally very little to be gained by launching a new product two years after the competitors made their product available unless very substantial improvements can be offered. Notable

examples of how advanced technology rather than price can give a particular company supremacy in a certain market are these: IBM in the computer field, Hewlett-Packard in electronic test instruments, Varian in the supply of klystron tubes. Some Canadian examples would be CAE's strong position in the supply of aircraft simulators, the success of deHavilland in the design of STOL aircraft (Cariboo, Otter, Beaver). Lately Northern Electric's Contempra telephone is a highly successful product showing great export potential.

In any field where products need to be produced and distributed in any sizeable quantities, economies of scale become very important. In such fields the value of total sales is usually quite high and this in turn determines the financial ability of a manufacturer to make further investments in R&D.

For any Canadian-owned manufacturer in the telecommunications field the ability to generate new product designs has become a matter of sheer survival. To some extent there will always be a need to do a certain amount of manufacturing in Canada under licenses from foreign firms, but there is a time lag involved in obtaining such purchased R&D information, normally some strings are attached restricting the licensee to certain markets and furthermore it is increasingly becoming necessary for a manufacturing firm to possess a very advanced level of skill in order to even be able to put into use technical information purchased from others. Such skill levels are usually only possessed by organizations which do some R&D on their own, so the paradoxical situation arises that in order to make use of R&D information purchased from others you have to be able to carry out R&D on your own.

A somewhat different situation exists for Canadian branch plants of foreign firms. In this case the close ties with the parent firm will usually facilitate the transfer of design information and less time lag will be involved in coordination of manufacturing know-how etc. There is no fixed pattern governing such situations as in some cases Canadian subsidiaries of foreign firms carry out a particular function for the entire corporation and do independent R&D in Canada.

VERTICAL AND HORIZONTAL INTEGRATION OF THE CANADIAN TELECOMMUNICATION INDUSTRY.

The existing organizational structure of the Canadian telecommunication industry has a major impact on the performance of this industry, particularly in encouraging manufacture of electronic equipment in Canada and in creating a strong R&D base for the industry.

The major organization in this field is the Bell Canada - Northern Electric complex which combines telecommunications operations, manufacturing and R&D within a single corporate structure. Another important integrated structure is the relationship between The British Columbia Telephone Company, Quebec Telephone, Lenkurt Electric (Canada) and Automatic Electric (Canada) which all belong to the same parent organization, The General Telephone & Electronics Corp. of New York, either as direct subsidiaries or through the holding company, The Anglo Canadian Telephone Company.

These organizations manufacture a wide range of telecommunication equipment for the Canadian market and for export, supplying all of the Canadian common carriers and not just their affiliated operating companies. To illustrate this point it may be useful to look at the distribution of the sales of the Northern Electric Company for the year 1969. In that year

the Company had total sales of $482.5 million, of which sales to Bell Canada accounted for $248.5, domestic non-Bell $183.4, and export $50.6. Nor is there any rigid rule within any of these integrated corporations that they will necessarily be self sufficient in all areas. Thus Bell Canada will make purchases of technical equipment from companies other than Northern Electric if a more appropriate product is available. Similarly, the B.C. Telephone Company will obtain certain types of equipment from companies other than Lenkurt or Automatic Electric, e.g. certain types of switching equipment.

By far the greater portion of Canadian R&D in the telecommunication field is performed by these integrated corporations. Thus in 1969 Bell-Northern had gross R&D expenses of $52.9 million, not counting R&D in the social sciences or on business information systems. This included both R&D performed in Canada and the value of purchased R&D. Northern Electric in 1969 performed $41.3 million R&D in its own laboratores and purchased technical information for $2.9 million, while Bell Canada performed R&D worth $2.6 million and purchased R&D for $5.9 million (from A.T.&T. Co.). In addition Northern Electric had capital expenditures of $6.2 million for R&D and Bell had capital expenditures of $.5 million.

Similarly, Automatic Electric (Canada) Ltd. is currently spending approx. $1 million annually on R&D in Canada and about $1 million annually for purchased R&D information. Lenkurt of Canada is currently spending $1.4 million on R&D in Canada and $.2 million on purchased R&D.

An annual rate of increase of 10% is expected in R&D expenditures. These figures are quoted here merely as a quide to the magnitude of the

current R&D activities in the integrated telecommunication organizations. It should be noted that such data are never directly comparable because of the many different transfer arrangements for technical information in effect throughout the industry, thus sometimes a parent organization will charge its subsidiaries in full for license information, technical knowhow etc. while in other cases such information is transferred freely without any special charges being made.

The Total Systems Concept

The basic philosophy underlying the integration in one corporation of telephone operations, manufacturing and research and development activities is the total systems concept. This simply implies that for best results all of the various factors influencing the development of the telecommunication carrier network must be taken into account in a total planning concept to ensure best results. This concept was first developed by the American Telephone and Telegraph Company but it is today a fact that most countries with highly developed public telecommunication system do have complete or partial integration of operations, manufacturing and R&D in this field. An interesting comment on this facet of A.T.&T. organization is given by the eminent economist John Kenneth Galbraith in his book, "The New Industrial State":

> From pages 364-365:
> "The railroads, under a different system of regulation, followed their own rather special pattern of development.[1]

---

[1]Most American railroads have had a pattern of development different from that of the firms of similar size in the industrial system. There is no similarly developed technostructure; for most of their history there has been no similar technical dynamic; there has been no similar capacity for taking control of prices, demand for the services, labor and capital supply and the other

requisites for successful planning. Regulations, prohibitions on mergers and diversification of activities and a tradition of routine, highly ritualized management of low technical aspiration and competence have all been factors. In Japan, France, Canada and other countries where there has been one national system or one or two dominant systems, the industry has had greater control over the requisites of its planning and its comparative performance value have been better. Each part provided a fraction of the total services of moving people locally and regionally; none, in consequence, could plan the entire service. None had appreciable authority over prices, use of service, capital supply or labor supply. None had a developed technostructure. In an industry which required planning, none of the requisites of planned performance were available. It is not surprising that the results have been singularly bad.

Although no parallels are exact, it is interesting to contemplate the different development of telephone service. This makes use of an old form of electronic communication. As in the case of the railroads and urban transit, alternative technology has been massively subsidized by the Federal government for military purposes. But in the telephone industry one giant corporation had planning authority coordinate with the whole task. It embraced both local and long-distance service. It had resources for competitive technical development and also for seeking government underwriting of such development where, as is usually the case, this could be justified by military application. The scale of A.T.&T. accorded it substantial authority over rates; it could enter actively on the management of the demand for its services; it had control over its capital supply; size combined with technological advance have enabled it to plan its labor requirements, keep them within the prospective supply and maintain authority over its labor force.

Had local telephone service been provided by one or more companies in each city, town and hamlet; had all these rates been subject to local regulation and influence; had long-distance service been supplied by numerous separate companies, only loosely coordinated with the local service; had there been little or no research or technical development anywhere in the system; had the local units been strongly dependent on external authority - municipal government or local banks - for capital; and had there been no planned provision for labor supply or substitute technology, it seems unlikely that telephonic communications could have survived in any very useful form.[2] That they flourished, none can doubt, is owing not to a mindless response to a free market but to the subordination of the market at all points to comprehensive planning."

---

[2]As a partial demonstration of the point, it has been suggested that, in the absence of automatic transmission of calls, it would require approximately the entire female working force of the country to handle current traffic.

The Canadian situation differs in degree from that of the U.S. but there can be no doubt that the application of the total planning concept has played a major role in giving us a telecommunication system of high quality. Due to special arrangements such as the service agreements existing between Bell Canada and other telephone companies, much of the basic planning information used by or originating in Bell Canada is made available to other Canadian telecommunication carriers, and similarly the R&D arm of the two integrated corporations Bell-Northern and B.C. Tel. - Lenkurt (Canada) - Automatic Electric (Canada) are very much interested in maintaining close liaison with all of the telecommunication carriers. These agreements will be discussed in more detail later.

The telecommunications network is in a very real sense growing organically as a living mechanism. Whenever new systems or equipment are incorporated into this network they must be compatible with the existing equipment but at the same time make use of the most modern technology and accommodate new and more sophisticated service needs. Because of the billions of interacting parts in the public telecommunication network extremely high reliability is required. Thus an electronic switching machine is designed and built to give reliability several orders of magnitude greater than commercial computers. The very marked increase in productivity which has taken place within the telecommunication carrier industry within the last decade, is largely due to improved technology and improved equipment reliability making it possible to provide installation and maintenance of a rapidly growing plant without a corresponding increase in maintenance and installation personnel.

Some of the advantages accruing to a telecommunication carrier from an integrated organization involving operations, manufacturing and R&D are these:

- Cordinated planning whereby the operating requirements of the telecommunication carrier, the state of the art in technology, the expertise in the systems engineering field of the R&D organization can all be brought to bear on a problem for optimum results.
- Decisions with respect to innovation can be taken for the long term, thus permitting innovative items to be introduced earlier than would be possible under a non-integrated method of operation which tends to insist on financial pay-off for the short term.
- Compatibility is stressed as the R&D and manufacturing organizations will possess an intimate knowledge of the existing network, the operating standards of that network and of any special technical problems existing as regards network operations.
- Maintainability of equipment is stressed. The telecommunication carrier has a special interest that equipment be designed which can be maintained at low cost by few people employing as much as possible regular maintenance personnel and standard test equipment. The preparation and availability of good maintenance and installation practices is important in this connection.

- Saving in engineering staff and effort. If the telecommunication carrier is able and willing to rely on the expertise and reliability of its associated manufacturer and the insight of R&D staff, a very considerable duplication in planning efforts may be avoided. In this case the relationship is essentially one of mutual trust. While the telecommunication carrier will always assume the role of the customer - and sometimes a customer who is very hard to please - little time is wasted in doing the same job twice.
- Exploratory R&D performed by the R&D laboratory on behalf of the telecommunication carrier and system engineering studies performed in advance of decisions on development of new systems play a key role in strengthening the technical decision-making capability of the operating company and ensuring that the most up-to-date technological knowledge is brought to bear on the solution of planning problems.
- The assurance that the right kind of equipment, built to the right standards, will be available when it is needed, and that maintenance parts, installation services, and technical assistance as required will be readily available.
- An organized maintenance and installation service will be available from one main source thus greatly simplifying the management of these services.
- Saving and simplification of supply services because the telecommunication carrier is able to keep a lower level of spare parts inventory without endangering the safety

of his equipment and may also rely on the manufacturer to keep the main spare parts inventory, while further savings are available because of simplified supply routes and administration.

- Generally lower prices because the manufacturing plant is able to plan for optimum production runs, runs little risk of wasting R&D and engineering effort on products for which there is no market, and is able to realize considerable savings in marketing, distribution and inventory stock. Obviously, these advantages only partially apply to a company supplying both an associated telecommunication carrier and the general equipment market but then on the other hand sales to the general market and for export help to lower production costs because of greater economies of scale.

- Exchange of personnel between R&D laboratories, manufacturing plant and the telecommunication carrier company entails considerable advantage for all parties. Thus it is essential for the Systems Engineering Department of an R&D laboratory to possess an intimate knowledge of the problems of telecommunications operations, and for this reason many of the systems engineers have many years of experience with operating companies. Similarly, a telecommunication carrier will often require personnel with a predominant R&D or manufacturing background for specialized tasks or simply to provide an infusion of new blood in the organization.

It should be noted that many of these advantages of an integrated type of organization can to a large degree be shared by independent telecommunication carrier companies which choose to avail themselves of the products and the assistance of the integrated corporations. On the other side the large independent portion of the market in many ways acts to stimulate and encourage a competitive attitude within the integrated R&D, manufacturing, and operating structure.

Some of the advantages accruing to the manufacturer and the associated R&D organization from an integrated type of corporate structure are these:

- Planning for new product development under a total systems concept in close cooperation with the telecommunication carrier provides the R&D systems engineers with a much better background of information on the requirements of the telecommunication carrier, a wealth of planning data, critical coordination of equipment specifications and design goals in advance of actual development work, and also provides the R&D organization and the manufacturing organization an opportunity to influence the planning activities of the carrier company.
- Knowledge of the requirements of the telecommunication carrier, the framework of costs agreed to, and the timing envisaged for development and manufacture, enables the R&D and the manufacturing organizations to do a better planning job subject to less uncertainty. In particular such knowledge aids in establishing a reasonable balance between commitment of funds to R&D and to engineering of manufacture.

- Consultation between the carrier, the R&D laboratory and the manufacturing plant during the development, manufacturing and installation phase proves helpful in eliminating "bugs" in equipment at an early stage. A particularly important aspect of new product development is field testing of the equipment, and this is usually undertaken in cooperation with the carrier.
- Close and continuous association with the telecommunication carrier on all phases of network technology strengthens the capability of the R&D and manufacturing organizations and also enables the manufacturer to offer similar assistance to customers outside of his own integrated corporation.
- The basic relationship of trust existing between the various arms of such an integrated organization enables the planners and the R&D staff to concentrate on problem solving without serving double duty as salesmen.
- Greater market stability and strong financial backing provides the manufacturer and his R&D organization with the ability to plan ahead and strive for a more efficient utilization of resources in plant and manpower than if such a partly stabilized market did not exist.
- In most areas of modern telecommunication technology size is important and is becoming more so in a market increasingly dominated by giant-sized international corporations. participation in an integrated corporation helps to establish a reasonable base of manufacturing operations which may be

enlarged through further expansion into the uncommitted markets.

- Constant feedback of information from the telecommunication carrier on the need for improvement in existing equipment helps the manufacturer to undertake product improvements which in turn help to prolong the useful lifespan of a product. A certain percentage of R&D effort will always need to be devoted to such product improvement.
- Exchange of manpower with the telecommunication carrier is very important for an R&D organization, particularly in the field of systems engineering.

The above enumeration of the advantages of industry integration should not be taken as an argument against the need for viable, smaller manufacturers in the telecommunication field. It is becoming increasingly evident that even the very largest manufacturing firms can not hope to provide all the needs of the telecommunications industry. The larger firms are not selfsufficient, thus the Northern Electric Company makes use of the services of approx. 5000 subcontractors in Canada and has contributed much assistance to many of these subcontractors to help them provide Canadian replacements for products which were previously imported. Also, there is a great scope for the smaller firm and the entrepreneur in mushrooming new fields such as CATV, business machines for use over the telecommunication system, data processing equipment, instrumentation, telemetering, and a long, long list of other specialties. There is thus no danger that the major corporations will preempt the field, on the contrary there is plenty of scope for everybody and there is no end in sight for the need to do expanded R&D in electronics.

<u>Some advantages of integration of the telecommunication industry from a national point of view are these</u>:

- Industry integration has been instrumental in developing a strong Canadian telecommunication manufacturing industry making a major contribution to the Canadian economy.
- The integrated telecommunication industry has led the way in technological innovation and contributed to giving Canada a public telecommunication service of high quality, providing service at reasonable rates by international standards.
- The major portion of Canadian R&D in the electronics field is performed by such integrated corporations. This effort is strongly supported by the operating companies which have done much to encourage industrial R&D in telecommunications in Canada.
- In times of emergency the Canadian telecommunication system is more secure because most of the technical equipment in this network is of Canadian manufacture - and increasingly also of Canadian design.
- The telecommunication carrier companies will in future years be investing billions of dollars in network expansion and modernization. This will represent a significant part of our total national investment. By substantially plowing these funds back into the Canadian industry through purchase of Canadian equipment and performance of indigenous R&D we help to strengthen

a particularly significant sector of the Canadian economy, which provides livelihood to 100,000 Canadians (in 1970).

- The growing strength of the Canadian telecommunication manufacturing industry is evident in the strengthened position of the industry in the export markets. This is a very encouraging sign.
- The telecommunications R&D laboratories are creating a need for highly competent technologists and scientists in Canada and will be a strong factor in stopping the "brain drain" to the U.S.
- From a national defence point of view the strong R&D establishments of the integrated corporations are a very real asset in peace or in war.
- If we are to accept the viewpoint of Servan-Schreiber, quoted earlier in this chapter, that "electronics is not an ordinary industry: it is the base upon which the next stage of industrial - and cultural - development depends" then it becomes doubly important to do everything in our power to build up a strong electronics industry in Canada, and there can be little doubt that the degree of integration existing in Canada between telecommunication operations, manufacturing and R&D has contributed much to our present strength in this field of technology.

<u>Subsidiaries of international companies</u> performing R&D or manufacturing in Canada are important in the industry. This really represents a different form of industry integration in that these companies draw part of their strength both in R&D and in marketing from the parent company.

Some of these companies do a substantial amount of R&D in Canada, such as RCA (Canada) which develops satellite communications ground stations and microwave relays on behalf of the RCA corporation, and otherwise engages in defence contracts and space work, mostly under contracts to the Federal Government. It is of interest to note that in the placement of defence contracts the Federal Government has in no way discriminated against subsidiaries of foreign companies as long as these companies performed R&D and manufacturing in Canada.

BELL CANADA - NORTHERN ELECTRIC

Because of the large size of this organization and its central position in the R&D field it would appear appropriate to describe the main features of this corporate structure.

Bell Canada is almost entirely Canadian-owned in the 95% of the equity capital and 98% of the shareholders are Canadian. It main operating subsidiaries are: The Newfoundland Telephone Company, New Brunswick Telephone Company and Northern Telephone Limited. Bell Canada also has majority ownership in the Maritime Telephone and Telegraph Company Limited but is restricted to voting 1000 shares only under Nova Scotia legislation. Northern Electric Company Limited is the main manufacturing subsidiary and is 100% owned by Bell Canada. The Northern Electric Company holds controlling interest in a new corporation, Microsystems International Limited, which has been established for the purpose of developing and manufacturing microcircuits for an international market and for use in domestic Canadian equipment. Up to the present time the R&D effort has been conducted by the Northern Electric Research and Development Laboratories with main laboratories

in Ottawa and branch laboratories in Montreal, Lachine, Belleville, Kanata, London, and Toronto. These are the largest industrial laboratories in Canada, employing more than 2000 persons, and performing R&D covering most of the telecommunications field. The establishment of these laboratories as a separate company has been announced with effect from 1 Jan. 1971. Formally the laboratories will be called the Bell Canada - Northern Electric Research Laboratories but the shorter name "Bell Northern Research" will be commonly used. This reorganization will give the Laboratories a stronger voice vis-a-vis Bell and Northern, and it might also be an advantage for non-Bell telecommunication carriers to be able to contract directly with the Laboratories for R&D in support of their operations and planning.

Northern Electric was reorganized in 1969 essentially along product lines. Thus both marketing and manufacturing of Switching Equipment were combined in one Company division, while similarly structured divisions were established for Transmission, Wire and cable, and Apparatus, respectively. The product line organization is somewhat modified by the establishment of a separate division for International Operations and another for Distribution Sales which will provide special marketing assistance and services for the product line divisions. Under this organizational concept each product line division will work with the R&D Laboratories and with Bell Canada in determining R&D programs for each product line and will provide funding in support of such R&D. Such program determination is mainly performed by Product Planning Committees, one for each product line, with the Systems Engineering Department of the Laboratories providing strong support through the preparation of a Prospectus for each project, coordination of

market forecasts, technological data etc. The principal involvement of Bell Canada is through the Planning and Research Department of Bell Canada HQ. Microsystems International Limited will also undertake a very agressive R&D program, part of which will be performed by the R&D Laboratories and part by MIL directly.

As previously mentioned, Bell Canada is particularly interested in exploratory development work which is performed by the Laboratories in advance of actual development work to provide insights and data for use in planning future development projects. Bell Canada funds 70% of such exploratory R&D with Northern Electric paying the other 30%. Development costs are in general recovered by Northern Electric through sales of equipment.

Prior to 1957 the Western Electric Company of the U.S. held a 43.6% interest in Northern Electric, the remaining stock being owned by Bell Canada. Partly as a result of the Consent Decree entered into in 1956 between the U.S. Department of Justice and the A.T.&T. Company, Western Electric sold its investment in Northern Electric to Bell Canada. Bell Canada acquired 89.97% ownership of Northern Electric in 1957, increased to 99.99% in 1962, and 100% in 1964.

Up to 1959 the Northern Electric Company had operated mainly as a manufacturing plant using design information originating with Western Electric Company and Bell Labs. It was felt this was not a desirable permanent situation, and in 1955 a study was made by Dr. C.J. Mackenzie, former President of the National Research Council, on the establishment of a centralized research and development laboratory. The R&D Laboratories were formally established in the summer of 1958.

Under a Service Agreement entered into in 1923 with the A.T.&T. Company on Services, Licenses and Privileges, and succeeded by a Service Agreement of 1949 which is still in force, Bell Canada has access to results of Bell Laboratory research and advice and assistance from the A.T.&T. Company on a wide range of matters, including general engineering, plant, traffic, operating, commercial, accounting and other matters and has the right to furnish such information to other operating companies in Canada. The agreement also gives Bell Canada the right to use of Bell Lab. and Western Electric patents and licenses and it may extend this right to its subsidiaries. Under agreements between Bell Canada and other Canadian telephone companies these companies also receive such information (excluding patents and licenses) but all companies do not contract for the same amount of information. It should be noted that the information received under the Service Agreement is <u>not</u> design information. It serves a very useful purpose in facilitating coordination of North-American telephone services and keeps us abreast of developments within the Bell System but does not contain the detailed manufacturing information nor design calculations and manufacturing knowhow.

Northern Electric has for many years had a Patent License Agreement and a Technical Information Agreement with Western Electric. Prior to 1959 Northern Electric under the terms of the Technical Information Agreement had rather free access to Western Electric design information and manufacturing knowhow. When the T.I.A. was renewed in 1959 for a further five years, and again in 1964, the amount of information obtained by Northern Electric under the T.I.A. was greatly reduced, and the economic terms became much less favourable. Essentially, Northern Electric is now in the same position

vis-a-vis Western Electric as any other manufacturing company, as any manufacturer may obtain patents and technical information from Western Electric on equal terms under the Consent Decree of 1956. The flow of information under the T.I.A. entered into in 1969 between Northern Electric and Western Electric has dwindled to a trickle and mainly comprises certain types of information on electronic switching. No manufacturing knowhow is included under the T.I.A.

The Technical Information Agreement may be considered a straight commercial agreement of decreasing significance to Northern Electric as most of Northern Electric's new designs are based on independent Canadian R&D. It will, however, be of some importance for some time to come because so many of Northern Electric's current products are based on original Western Electric designs or make use of W.E. patents.

The main significance of the A.T.&T. Company - Bell Canada Service Agreement to Northern Electric is that under the terms of this agreement Northern Electric makes use of W.E. patents without paying royalties on sales to Bell Canada or its operating subsidiaries but has to make a charge to cover royalty payments on sales to other companies if any W.E. patents are used in equipment sold.

It will be evident from the above that the special relationship which once existed between Western Electric and Northern Electric has undergone a drastic change in the past ten years and that today nothing more than a straight commercial relationship remains. Fortunately, the R&D capability of Northern Electric has now expanded very significantly but even then it is beyond the resources of that organization to generate

designs covering all the requirements of the operating industry. The most important thing is to concentrate efforts on those projects which are really important. A major concern in preparing an R&D program is therefore to make the right Make or Buy decisions.

In 1969 Northern Electric's performed R&D amounted to approx. $41.3 million while the value of information purchased from Western Electric was $2.9 million. The corresponding figures for Bell Canada were: Performed R&D $2.6 million, purchased R&D (From A.T.&T. $5.9 million). The R&D budget of Northern Electric has been increasing at a rate of $5 million annually for some years now and should continue to do so over the next five-year period unless the current shortage of funds continues and forces a stop to this expansion.

Nor should it be forgotten in discussion of R&D being performed by the R&D Laboratories that some very worthwhile R&D is also being undertaken directly by Bell Canada. Such telecommunication carrier R&D is normally concerned with special assembly work to engineer a system to suit a specific function but some larger efforts such as the SWAP system development, which is a radio paging system for wide area use, have been undertaken by Bell engineering staff. A considerable amount of development work is also being done in the operating industry in the area of improved technology for burying cables, improved maintenance practices, etc. Bell Canada is also actively engaged in research in the demographic and social science field, in cooperation with the University of Toronto and Université de Montréal.

INNOVATION IN THE OPERATING INDUSTRY

The telecommunication carriers are engaged in a continuing process of innovation to keep abreast of the growing demands for new and more sophisticated demands for telecommunication services, to expand the existing network facilities as part of a natural growth process, and to modernize or replace existing plant which no longer is able to meet the exacting demands of the network. A major aim of this process of innovation is to increase productivity, and this industry has been highly successful in absorbing greatly increased equipment costs and an increased tax burden, as well as greatly increased salary expenses, through increases in efficiency. Only very recently - in the last three years - has the inflationary trend in our economy been so pronounced as to outstrip the industry's ability to compensate for spiralling costs through productivity increases alone. Undoubtedly the strong technological position of the telecommunication carriers, combined with the efforts of the manufacturing industry and R&D organizations in support of the carriers, has been a decisive factor in promoting this flow of innovation in the carrier industry. It must be observed that innovation encompasses something far more than the introduction of modern equipment and complex communications systems. It is a way of life - it is a constant striving to do things better - to provide better service through better facilities, using improved methods and procedures, improved management of the network, and to employ resources-people, technology and capital-to best advantage.

The various problems and opportunities for R&D and innovation in the field of telecommunication technology have been well described in Telecommission study 4(a) on the Future of Technology and will not be

repeated here. Let it just be mentioned that such technological problems very often arise from a need in the operating field. An example of this was the introduction of Direct Distance Dialling (DDD). By the end of the forties it was becoming clear that the telephone companies were experiencing serious difficulty in engaging enough long-distance operators to cope with a burgeoning demand for long distance calls. The logical answer was the introduction of DDD which was undertaken on a North-American basis, starting in 1958 in Canada. Today a problem is experienced in coping with the relatively small proportion of calls which still require operator assistance, and the answer to this problem is expected to be the development of a New Traffic Service Position System based on the SP-1 stored program switching machine. This system will not replace telephone operators but will help to streamline their work functions and the attendants' equipment so as to make it possible for one operator to serve more customers.

The computerization of billing, accounting, and supply services has proceeded systematically at a rapid pace, and the telecommunication carriers are leading the way in the adaptation of computers to industrial uses.

Another major innovation program is the increased use of buried plant by all TCTS companies. This has advantages from a maintenance as well as from an esthetic point of view, and Alberta Government Telephones in particular have come very far under their program to place most rural cables underground.

The next major steps in innovation will probably be increased use of Pulse Code Modulation (PCM) transmission and switching systems because such systems will be particularly well suited to the transmission and switching

of data traffic at low error rates and also have advantages for voice communication over very long distances. The introduction of PCM technology first became feasible with the invention of the transistor but it took the development of integrated circuits, so-called micro-circuits, to put the development of major PCM systems within economic reach. The extensive application of modular microcircuits on a plug-in basis, self-checking error circuits, and a high degree of redundancy in elements of such micro-circuits will in turn be the answer to an operational need on the part of the telecommunication carriers for equipment of still higher reliability to minimize the maintenance requirements and simplify repairs.

Incidentally, the establishment of Micro-systems International Limited in 1969 is a prime example of joint Government-Industry action to solve a major problem in industrial development. In this instance the Advanced Devices Centre of the Northern Electric Company had been actively developing semiconductors and microcircuits for some years but it was not possible within the existing economic framework to undertake this project on a really major scale. The Department of Industry, Trade and Commerce recognized the need for a really major Canadian effort in the field of micro-circuits and provided very extensive economic backing (about $48 million) in the form of conditional grants and loans which made it feasible to establish Micro-systems International Limited as major contender for a good slice of the international market for micro-circuits for telecommunication systems. The potential rewards are large in this field but a substantial element of risk is involved for Northern Electric and Bell Canada in this venture. MIL alone intends to invest $42 million in R&D on micro-circuits over the first five-year period of its life. This project

is probably more significant than any other specific R&D project, because if the venture is successful a basis will have been established for another Canadian quantum leap in electronic technology.

Generation of R&D - Product Cycle

The subject of defining the precise relationship between technological growth, innovation and R&D has not been extensively researched to date. From what literature is available on this subject it would appear that no simple relationship between spending on R&D and technological growth can be established. This would appear reasonable as many other factors such as the general level of education of a country, popular expectations, social environment, managerial competence, and many other factors have a bearing on how fruitful an R&D program will be as a stimulant of industrial growth. What is certain, however, is that without R&D and an attendant high level of technological competence no company, nor any nation, can hope to achieve preeminence in science-based industries.

Certain other factors also deserve attention such as the fact that high growth companies in the electronic field not only possess technological skills but are characterized by earning an above-average return on investment. Thus Servan-Schreiber in "The American Challenge" (page 79) quotes economists maintaining that net profits should be 12-13 percent of equity capital in order to maintain growth in areas of advanced technology. Canadian industry has consistently fallen short of this target which may be deserving of more attention not only on the part of industry but even more so by governments.

Various attempts have been made to predict the requirements for

R&D in terms of "product cycles" and growth rates, and such considerations undoubtedly add to our understanding of the overall problem; but as sometimes changes in technology occur by fairly sudden leaps rather than by a smoothly continuous process, long term prediction is not an easy task. It is generally true that the life-expectancy of new electronic equipment is declining in spite of increased equipment reliability because the equipment is likely to become obsolescent before it is worn out. Such obsolescence may occur either because of functional improvements in newer equipment or because of style changes in the case of customer equipment.

In the case of equipment on telecommunication carrier premises obsolescence is more likely to be functional, e.g. older equipment can not perform additional functions without extensive modification or newer equipment is more compact and easier to maintain. In either case the useful life expectancy equipment is generally becoming shorter, and to stay on top a manufacturer of telecommunication equipment constantly has to update his equipment and replace older products with completely new designs at more frequent intervals. With one blow the transistor made most of the older vacuum tube technology obsolete, and integrated semiconductor circuits promise to make designs using discrete components obsolete for many, if not for all, applications. This means that a telecommunication carrier in addition to the requirement for new equipment for network extension and the provision of new types of services must also on an average count on having to replace all existing plant after a certain number of years. So-called "planned obsolescence" has never been encouraged by the telecommunication carrier industry - as on the contrary equipment is generally built to last a lifetime, but nevertheless the effects of a shortened

product cycle is being felt at both the operating and manufacturing level and is a prime reason why a strong R&D capability is a necessity for survival as far as any manufacturing concern in the telecommunication field is concerned.

To support such a strong R&D capability in a broad field large size is required and moreover many products for the telecommunication carrier industry can only be manufactured economically in very large quantities. Increasingly the large international corporations will become even larger and use their tremendous technological capacity and large scale economy of production to offer much stiffer competition in the world's markets - and on our doorstep. Even Northern Electric Company is only a medium-sized company by international standards and it is therefore essential that Canadian industrial policy should encourage larger size and continued expansion and diversification of Canadian industry. At the same time it should be recognized that in many special fields size is of less importance, and every effort should therefore also be made to encourage the smaller firms and the entrepreneurial enterprise.

APPENDIX 2

Statistical Data - Trans-Canada Telephone System.

DATA FROM ANNUAL REPORTS

MEMBERS OF THE TRANS-CANADA TELEPHONE SYSTEM

TOTAL TELEPHONES

	31 Dec 69	31 Dec 68	Increase	Incr 69/68	Avg Annual Incr 10 yrs
				%	%
Newfoundland Telephone Company Limited	88,247	82,645	5,602	6.8	6.8
Maritime Telegraph and Telephone Company, Limited	269,211	256,388	12,823	5.0	5.4
The New Brunswick Telephone Company, Limited . .	214,820	206,507	8,313	3.9	5.9
Bell Canada	5,752,820	5,450,782	302,038	5.5	5.6
Manitoba Telephone System*	402,967	385,892	17,075	4.4	4.8
Saskatchewan Telecommunications	306,883	297,009	9,874	3.3	5.9
Alberta Government Telephones	468,371	431,075	37,296	8.7	8.9
British Columbia Telephone Company*	974,823	914,304	60,519	6.6	6.8
TRANS-CANADA TELEPHONE SYSTEM	8,478,142	8,024,602	453,540	5.7	5.9

* NOTES

Manitoba Telephone System: year ending 31 March.
British Columbia Telephone Company: 1967-1969 includes Okanagan Telephone Company.

DATA FROM ANNUAL REPORTS

MEMBERS OF THE TRANS-CANADA TELEPHONE SYSTEM

TOTAL OPERATING REVENUES

	1969	1968	Increase	Incr 69/68	Avg Annual Incr 10 yrs
	$	$	$	%	%
Newfoundland Telephone Company Limited	13,261,627	11,675,793	1,585,834	13.6	18.0
Maritime Telegraph and Telephone Company, Limited	38,390,039	35,207,617	3,182,422	9.0	10.0
The New Brunswick Telephone Company, Limited . .	35,332,002	31,965,092	3,366,910	10.5	9.8
Bell Canada	842,090,131	758,477,957	83,612,174	11.0	8.4
Manitoba Telephone System*	48,478,143	43,333,199	5,144,944	11.9	9.7
Saskatchewan Telecommunications	47,094,799	43,265,574	3,829,225	8.9	9.6
Alberta Government Telephones	98,847,686	86,755,471	12,092,215	13.9	15.4
British Columbia Telephone Company*	158,044,000	139,389,349	18,654,651	13.4	11.2
TRANS-CANADA TELEPHONE SYSTEM	1,281,538,427	1,150,070,052	131,468,375	11.4	9.3

* See notes on page 1.

May 1970

DATA FROM ANNUAL REPORTS

MEMBERS OF THE TRANS-CANADA TELEPHONE SYSTEM

LOCAL SERVICE REVENUES

	1969	1968	Increase	Incr 69/68	Avg Annual Incr 10 yrs
	$	$	$	%	%
Newfoundland Telephone Company Limited	6,765,830	6,135,505	630,325	10.3	15.6
Maritime Telegraph and Telephone Company, Limited	19,574,955	18,239,743	1,335,212	7.3	8.3
The New Brunswick Telephone Company, Limited . .	14,740,601	13,665,927	1,074,674	7.9	7.3
Bell Canada	472,827,086	437,553,742	35,273,344	8.1	7.3
Manitoba Telephone System*	21,498,292	20,199,594	1,298,698	6.4	6.1
Saskatchewan Telecommunications	17,427,915	16,416,314	1,011,601	6.2	8.6
Alberta Government Telephones	32,149,350	28,857,905	3,291,445	11.4	13.2
British Columbia Telephone Company*	78,363,000	72,640,898	5,722,102	7.9	8.3
TRANS-CANADA TELEPHONE SYSTEM	663,347,029	613,709,628	49,637,401	8.1	7.7

* See notes on page 1.

DATA FROM ANNUAL REPORTS

MEMBERS OF THE TRANS-CANADA TELEPHONE SYSTEM

TOLL SERVICE REVENUES

	1969	1968	Increase	Incr 69/68	Avg Annual Incr 10 yrs
	$	$	$	%	%
Newfoundland Telephone Company Limited	6,384,357	5,414,898	969,459	17.9	22.8
Maritime Telegraph and Telephone Company, Limited	17,948,927	16,121,997	1,826,930	11.3	12.0
The New Brunswick Telephone Company, Limited . .	19,572,207	17,369,566	2,202,641	12.7	12.0
Bell Canada	329,209,338	284,713,476	44,495,862	15.6	10.5
Manitoba Telephone System*	25,390,408	21,685,060	3,705,348	17.1	14.3
Saskatchewan Telecommunications	28,249,646	25,542,822	2,706,824	10.6	10.2
Alberta Government Telephones	62,865,148	54,176,491	8,688,657	16.0	16.7
British Columbia Telephone Company*	74,969,000	63,391,164	11,577,836	18.3	15.8
TRANS-CANADA TELEPHONE SYSTEM	564,589,031	488,415,474	76,173,557	15.6	12.0

* See notes on page 1.

DATA FROM ANNUAL REPORTS

MEMBERS OF THE TRANS-CANADA TELEPHONE SYSTEM

TOTAL OPERATING EXPENSES#

	1969	1968	Increase	Incr 69/68	Avg Annual Incr 10 yrs
	$	$	$	%	%
Newfoundland Telephone Company Limited	9,594,006	8,033,525	1,560,481	19.4	20.8
Maritime Telegraph and Telephone Company, Limited	24,037,755	21,380,720	2,657,035	12.4	9.6
The New Brunswick Telephone Company, Limited . .	22,929,514	20,357,565	2,571,949	12.6	10.2
Bell Canada	530,200,446	463,986,847	66,213,599	14.3	7.5
Manitoba Telephone System*	36,765,099	33,011,332	3,753,767	11.4	8.8
Saskatchewan Telecommunications	30,332,587	28,586,623	1,745,964	6.1	7.4
Alberta Government Telephones	73,505,234	66,389,913	7,115,321	10.7	15.0
British Columbia Telephone Company*	100,856,000	87,878,499	12,977,501	14.8	10.8
TRANS-CANADA TELEPHONE SYSTEM	828,220,641	729,625,024	98,595,617	13.5	8.7

* See notes on page 1.
# Includes Depreciation, excludes Taxes and Interest Charges.

DATA FROM ANNUAL REPORTS

MEMBERS OF THE TRANS-CANADA TELEPHONE SYSTEM

TOLL MESSAGES

	1969	1968	Increase	Incr 69/68	Avg Annual Incr 10 yrs
				%	%
Newfoundland Telephone Company Limited	4,967,900	4,606,400	361,500	7.8	11.7
Maritime Telegraph and Telephone Company, Limited	13,900,562	13,112,092	788,470	6.0	7.2
The New Brunswick Telephone Company, Limited . .	9,793,718	9,012,863	780,855	8.7	9.1
Bell Canada	271,762,924	243,080,492	28,682,432	11.8	7.0
Manitoba Telephone System*	14,300,000	12,900,000	1,400,000	10.9	6.5
Saskatchewan Telecommunications	18,272,000	17,351,000	921,000	5.3	6.5
Alberta Government Telephones	38,558,467	34,786,774	3,771,693	10.8	10.8
British Columbia Telephone Company*	38,333,479	33,094,626	5,238,853	15.8	8.1
TRANS-CANADA TELEPHONE SYSTEM	409,889,050	367,944,247	41,944,803	11.4	7.5

* See notes on page 1.

DATA FROM ANNUAL REPORTS

MEMBERS OF THE TRANS-CANADA TELEPHONE SYSTEM

TOTAL TELEPHONE PLANT

	31 Dec 69	31 Dec 68	Increase	Incr 69/68	Avg Annual Incr 10 yrs
	$	$	$	%	%
Newfoundland Telephone Company Limited	55,379,535	50,393,805	4,985,730	9.9	12.5
Maritime Telegraph and Telephone Company, Limited	172,101,198	159,475,188	12,626,010	7.9	10.1
The New Brunswick Telephone Company, Limited . .	159,076,755	146,461,480	12,615,275	8.6	9.7
Bell Canada	3,593,443,180	3,279,224,000	314,219,180	9.6	8.9
Manitoba Telephone System*	263,764,855	239,054,762	24,710,093	10.3	8.2
Saskatchewan Telecommunications	217,707,821	202,533,233	15,174,588	7.5	8.3
Alberta Government Telephones	476,382,011	420,508,342	55,873,669	13.3	13.4
British Columbia Telephone Company*	678,715,000	616,604,753	62,110,247	10.1	10.8
TRANS-CANADA TELEPHONE SYSTEM	5,616,570,355	5,114,255,563	502,314,792	9.8	9.4

* See notes on page 1.

DATA FROM ANNUAL REPORTS

MEMBERS OF THE TRANS-CANADA TELEPHONE SYSTEM

CONSTRUCTION EXPENDITURES

	1969	1968	Increase	Incr 69/68	Avg Annual Incr 10 yrs
	$	$	$	%	%
Newfoundland Telephone Company Limited	6,514,027	6,708,206	(194,179)	(2.9)	11.4
Maritime Telegraph and Telephone Company, Limited	17,747,526	19,165,684	(1,418,158)	(7.4)	8.6
The New Brunswick Telephone Company, Limited . .	17,176,351	14,572,454	2,603,897	17.9	11.2
Bell Canada	389,326,223	338,628,855	50,697,368	15.0	7.1
Manitoba Telephone System*	32,000,000	28,600,000	3,400,000	11.9	10.6
Saskatchewan Telecommunications	22,866,417	22,590,454	275,963	1.2	10.5
Alberta Government Telephones	69,700,000	57,721,000	11,979,000	20.8	8.9
British Columbia Telephone Company*	74,000,000	70,802,771	3,197,229	4.5	6.1
TRANS-CANADA TELEPHONE SYSTEM	629,330,544	558,789,424	70,541,120	12.6	7.6

* See notes on page 1.

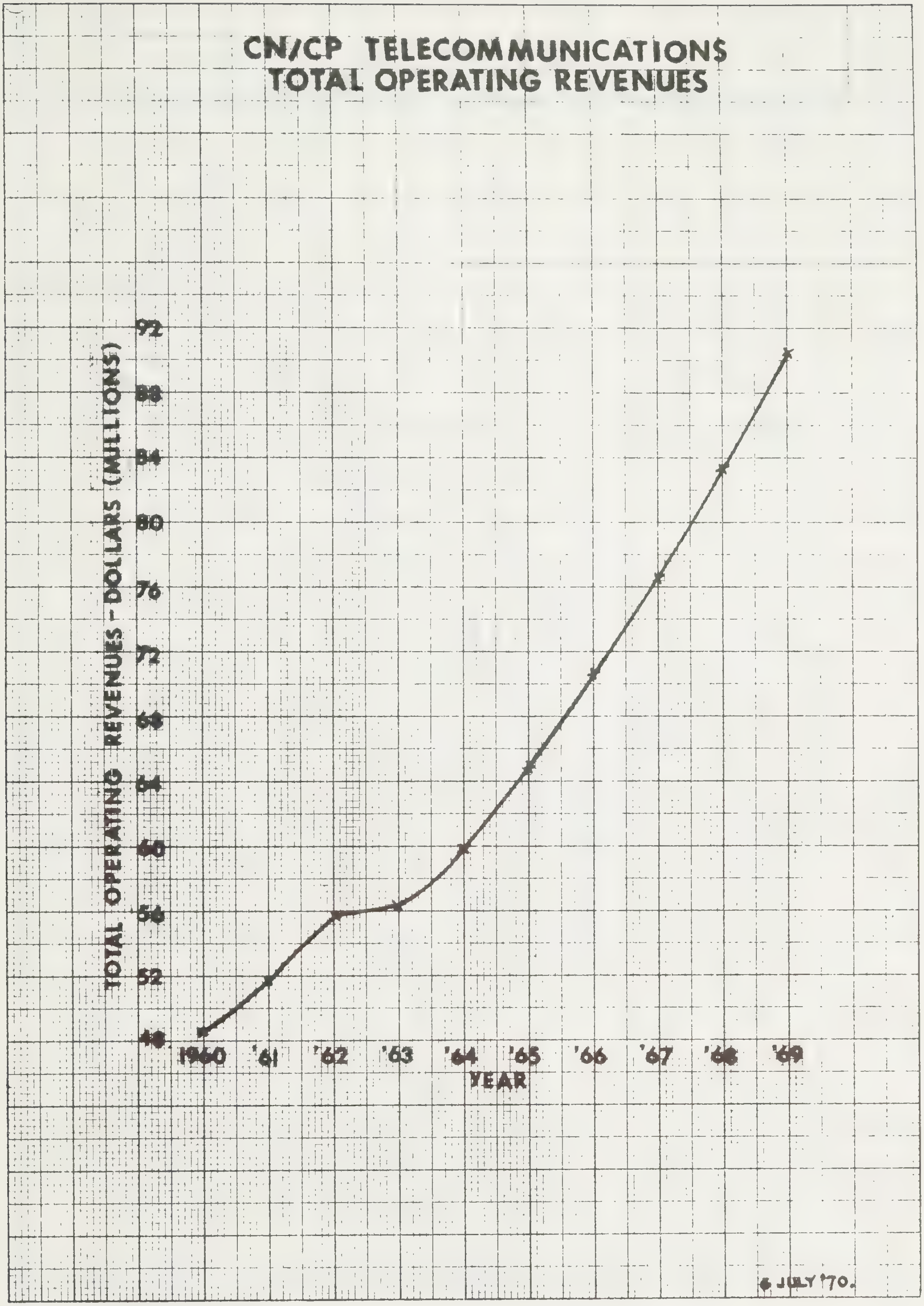
NUMBER OF EMPLOYEES

	31 Dec 69	31 Dec 68	Increase	Incr 69/68	Avg Annual Incr 10 yrs
				%	%
Newfoundland Telephone Company Limited	849	835	14	1.7	4.6
Maritime Telegraph and Telephone Company, Limited	2,469	2,474	(5)	(0.2)	3.0
The New Brunswick Telephone Company, Limited . .	2,069	1,992	77	3.9	2.7
Bell Canada	38,686	37,489	1,197	3.2	0.4
Manitoba Telephone System*	4,159	4,257	(98)	(2.3)	2.3
Saskatchewan Telecommunications	2,435	2,447	(12)	(0.5)	2.0
Alberta Government Telephones	6,791	6,360	431	6.8	6.5
British Columbia Telephone Company*	8,889	7,991	898	11.2	3.7
TRANS-CANADA TELEPHONE SYSTEM	66,347	63,845	2,502	3.9	1.7

* See notes on page 1.

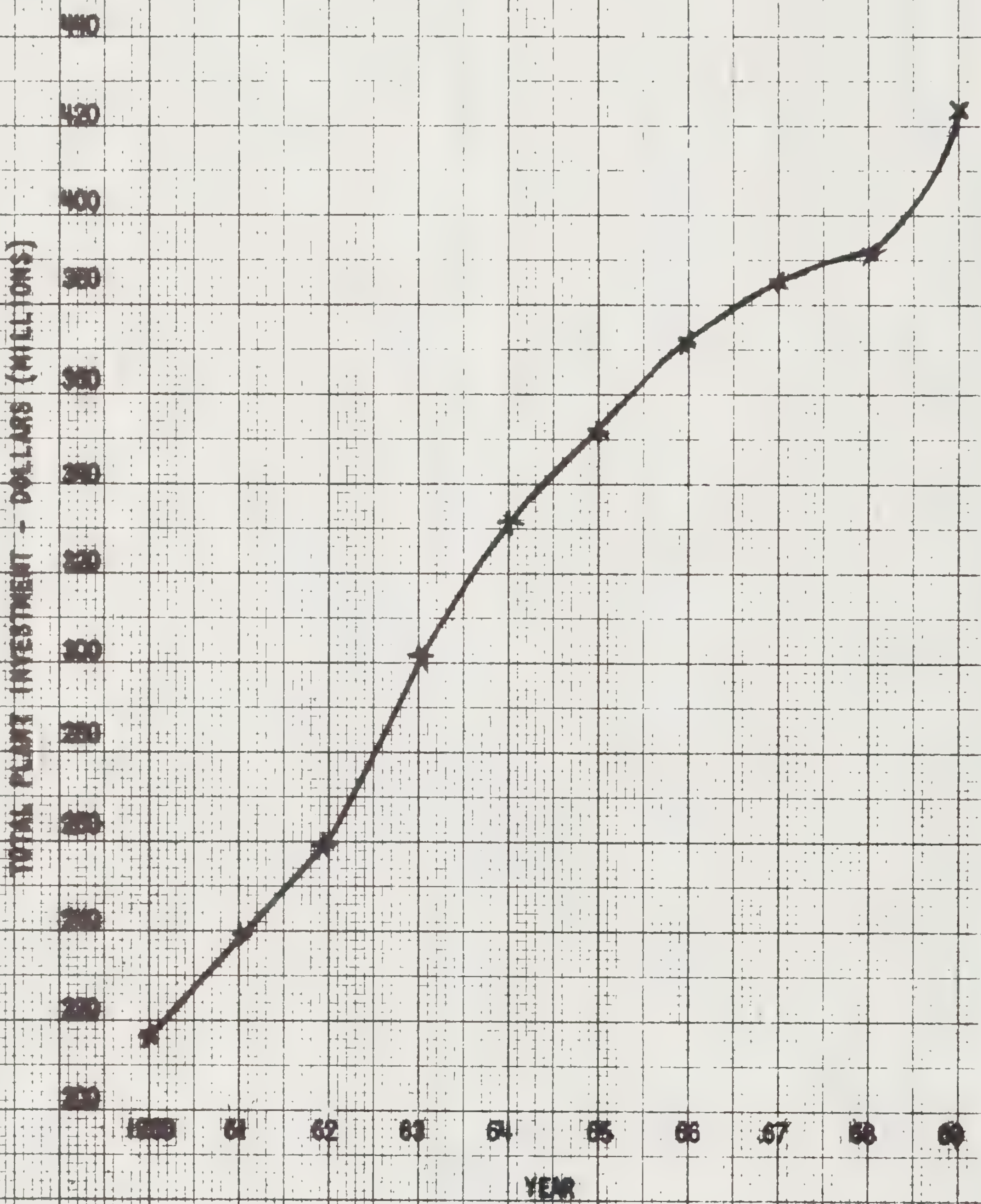
APPENDIX 3

Statistical Data - CN/CP Telecommunications.

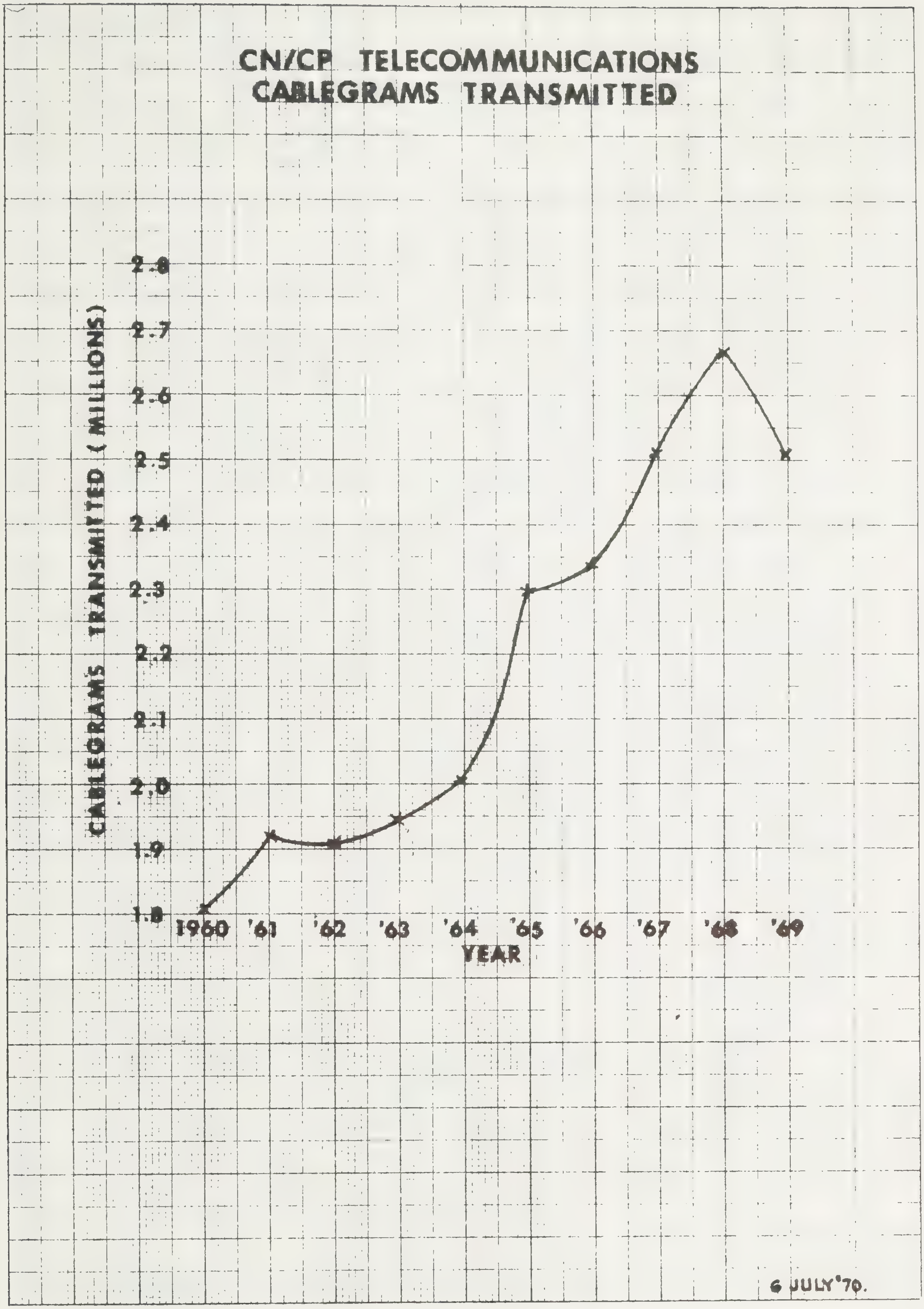


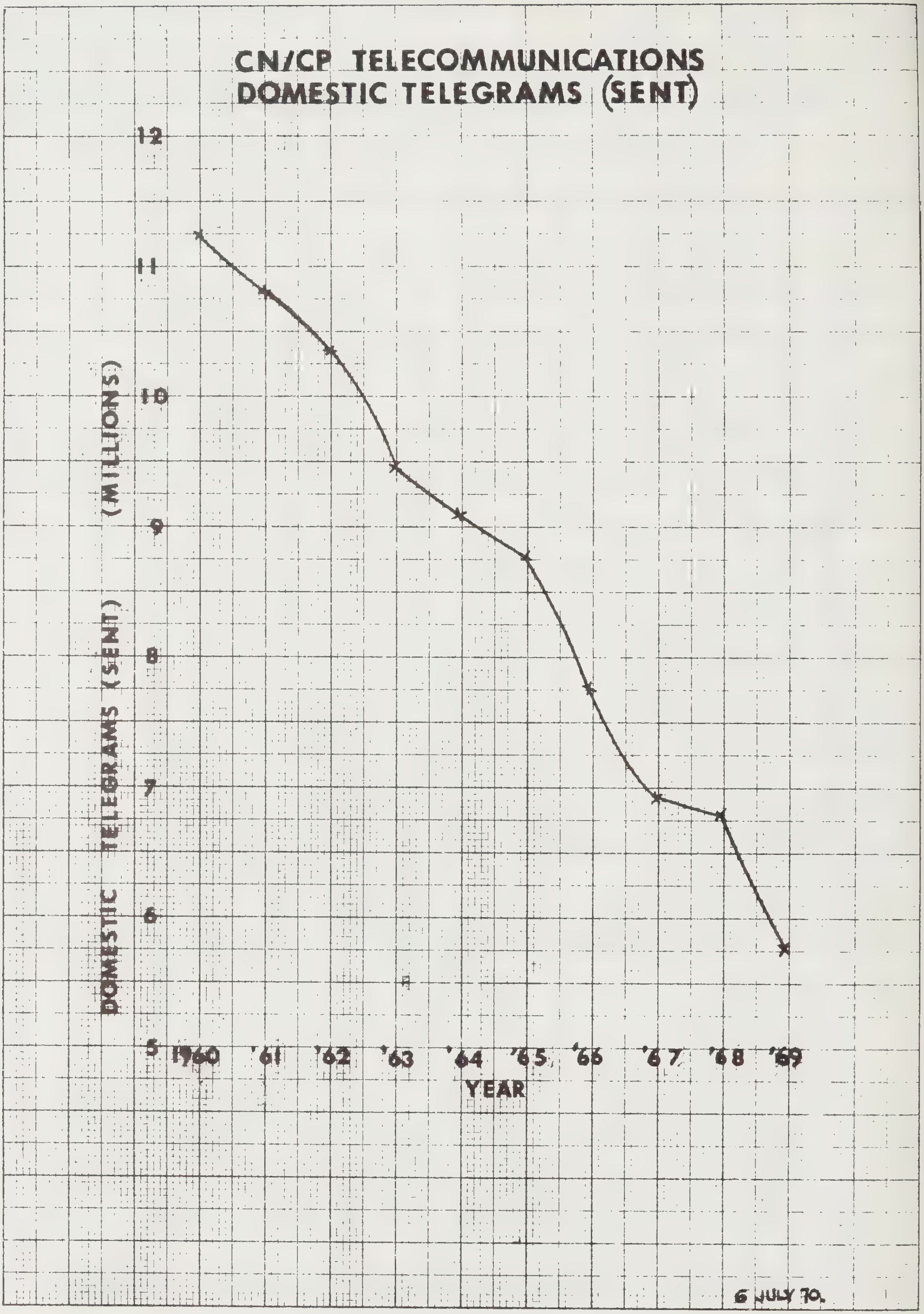
CN/CP TELECOMMUNICATIONS
TOTAL OPERATING REVENUES
TOTAL OPERATING REVENUES - DOLLARS (MILLIONS)
92
88
84
80
76
72
68
64
60
56
52
48
1960
'61
'62
'63
'64
'65
'66
'67
'68
'69
YEAR
6 JULY '70.

CN/CP TELECOMMUNICATIONS
TOTAL PLANT INVESTMENT (BEFORE DEPRECIATION)

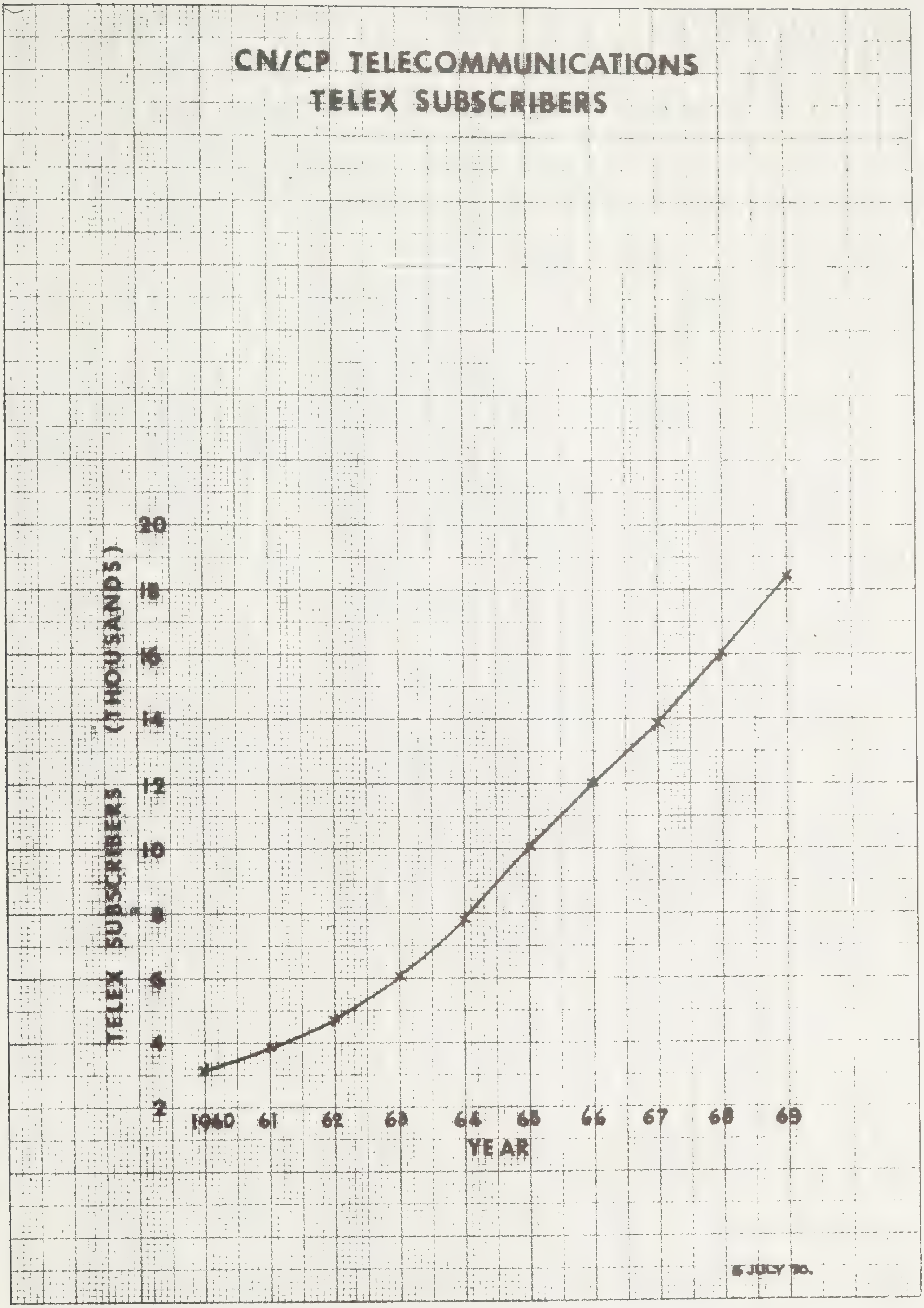


6 JULY 70.


CN/CP TELECOMMUNICATIONS
CABLEGRAMS TRANSMITTED
CABLEGRAMS TRANSMITTED (MILLIONS)
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2.0
1.9
1.8
1960
'61
'62
'63
'64
'65
'66
'67
'68
'69
YEAR
6 JULY '70.



CN/CP TELECOMMUNICATIONS
DOMESTIC TELEGRAMS (SENT)
DOMESTIC TELEGRAMS (SENT) (MILLIONS)
12
11
10
9
8
7
6
5
1960
'61
'62
'63
'64
'65
'66
'67
'68
'69
YEAR
6 JULY 70.



CN/CP TELECOMMUNICATIONS
TELEX SUBSCRIBERS
TELEX SUBSCRIBERS (THOUSANDS)
20
18
16
14
12
10
8
6
4
2
1960
61
62
63
64
65
66
67
68
69
YEAR
6 JULY 70.

APPENDIX 4

Extracts from "The World's Telephones" published January 1969 - AT&T.

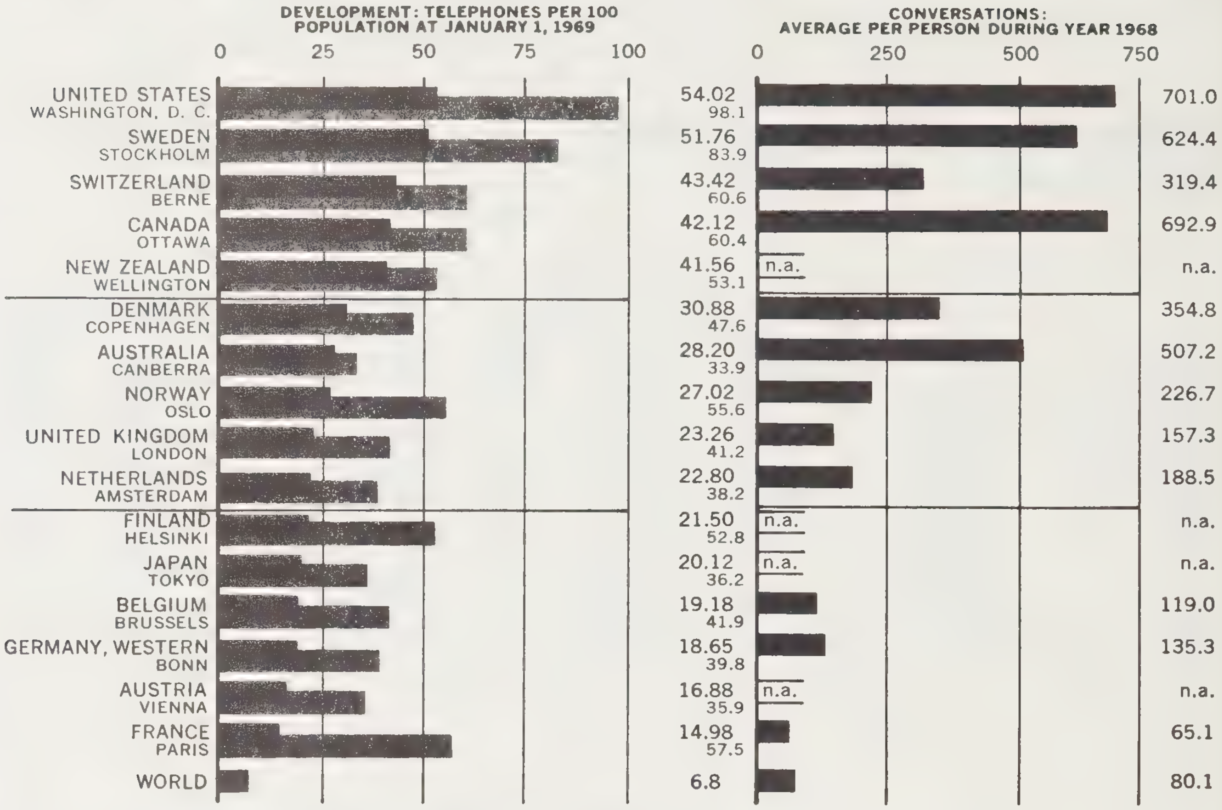
Telephones by continental area

Data are at January 1

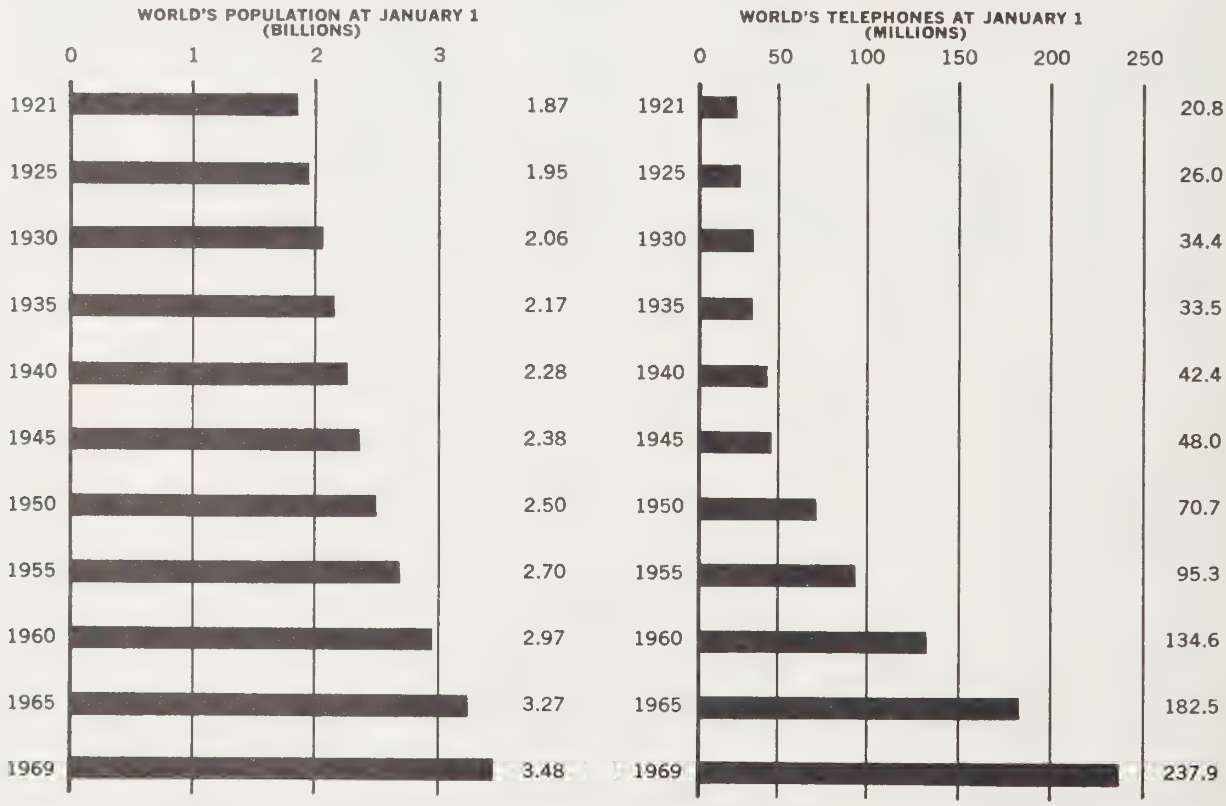
CONTINENT	TOTAL IN SERVICE NUMBER 1969	TOTAL IN SERVICE PER CENT OF WORLD	TOTAL IN SERVICE PER 100 POPULATION	PRIVATELY OPERATED[1] NUMBER 1969	PRIVATELY OPERATED[1] PER CENT OF TOTAL	AUTOMATIC NUMBER 1969	AUTOMATIC PER CENT OF TOTAL	CONNECTING WITH BELL SYSTEM NUMBER 1969	CONNECTING WITH BELL SYSTEM PER CENT OF TOTAL
NORTH AMERICA	117,686,000	49.5	52.7	116,134,000	98.7	117,427,000	99.8	117,684,000	100.0
MIDDLE AMERICA	2,224,000	0.9	2.5	1,689,000	75.9	2,084,000	93.7	2,220,000	99.8
SOUTH AMERICA	4,924,000	2.1	2.7	2,334,000	47.4	4,423,000	89.8	4,801,200	97.5
EUROPE	77,359,000	32.5	12.0	13,502,000	17.5	70,986,000	91.8	74,063,000	95.7
AFRICA	2,961,000	1.2	0.9	25,000	0.8	2,345,000	79.1	2,779,000	93.9
ASIA	27,628,000	11.6	1.4	19,834,000	72.2	22,532,000	81.7	22,523,000	81.7
OCEANIA	5,118,000	2.2	26.5	399,000	7.8	4,504,000	88.0	5,110,000	99.8
WORLD	237,900,000	100.0	6.8	153,917,000	64.7	224,301,000	94.3	229,180,000	96.4

CONTINENT	TOTAL NUMBER OF TELEPHONES IN SERVICE 1968	1967	1966	1965	1964	1959
NORTH AMERICA	111,773,000	106,341,000	100,779,000	95,509,000	90,824,000	71,799,000
MIDDLE AMERICA	2,004,000	1,810,000	1,641,000	1,500,000	1,389,000	911,000
SOUTH AMERICA	4,635,000	4,469,000	4,242,000	4,072,000	3,873,000	3,000,000
EUROPE	71,866,000	66,976,000	62,432,000	58,138,000	54,112,000	37,598,000
AFRICA	2,766,000	2,618,000	2,474,000	2,360,000	2,242,000	1,769,000
ASIA	24,531,000	21,746,000	19,261,000	16,875,000	14,748,000	7,555,000
OCEANIA	4,825,000	4,540,000	4,271,000	4,046,000	3,812,000	2,868,000
WORLD	222,400,000	208,500,000	195,100,000	182,500,000	171,000,000	125,500,000

C untries with 1,000,000 or more telephones and 15 per 100 population



Growth of population and telephones



Telephone conversations during the year 1968

Number in Thousands

AREA	LOCAL	LONG DISTANCE	TOTAL	AVG. PER PERSON
Algeria	122,772	212,774	335,546	25.9
Angola	26,656	927	27,583	5.1
Argentina	3,912,160	64,565	3,976,725	168.4
Australia	2,295,000	152,040	2,447,040	205.8
Bahama Islands	74,595	475	75,070	507.2
Belgium	899,989	244,910	1,144,899	119.0
Bermuda	20,774	178	20,952	410.8
Brazil	9,364,206	187,346	9,551,552	108.3
Burma	77,106	2,182	79,288	3.0
Cambodia	6,601	863	7,464	1.1
Canada	14,003,930	389,720	14,393,650	692.9
Ceylon	63,887	7,937	71,824	6.0
Chad	3,941	40	3,981	1.2
Channel Islands	28,150	2,256	30,406	271.5
Chile	776,636	26,716	803,352	85.9
China, Taiwan	969,347	21,454	990,801	73.6
Congo, Brazzaville	7,577	604	8,181	9.4
Congo, Democratic Rep.	148,975	326	149,301	8.9
Costa Rica	94,598	6,090	100,688	61.4
Cyprus	36,489	3,689	40,178	64.6
Czechoslovakia	1,139,703	138,826	1,278,529	89.0
Denmark	1,299,358	428,505	1,727,863	354.8
Ethiopia	53,767	2,590	56,357	2.3
Fiji Islands	29,900	734	30,634	60.7
France	2,139,125	1,108,450	3,247,575	65.1
French Guiana	1,638	60	1,698	42.5
Germany, Eastern	881,894	319,549	1,201,443	70.3
Germany, Western	5,554,320	2,586,605	8,140,925	135.3
Ghana	32,578	8,166	40,744	4.9
Gibraltar	8,068	82	8,150	326.0
Greece	1,335,617	65,813	1,401,430	159.2
Guadeloupe	5,594	568	6,162	19.4
Guyana	15,134	2,175	17,309	24.4
Hungary	583,636	34,249	617,885	60.3
Iceland	119,800	7,231	127,031	632.0
India	1,504,000	103,234	1,607,234	3.1
Indonesia	166,221	7,746	173,967	1.5
Iraq	195,595	1,056	196,651	22.8
Ireland	261,000	31,634	292,634	100.6
Italy	8,070,305	1,054,433	9,124,738	173.0
Ivory Coast	25,500	769	26,269	6.4
Jamaica, West Indies	106,000	1,721	107,721	56.3
Kenya	4,004	2,590	6,594	6.5
Korea, Rep. of	1,322,568	55,972	1,378,540	45.2
Lebanon	359,000	49,500	408,500	158.4
Liechtenstein	2,681	3,191	5,872	279.6
Madagascar	20,519	828	21,347	3.3
Martinique	7,937	68	8,005	24.7
México	2,450,190	47,889	2,498,079	52.9
Monaco	3,867	5,148	9,015	392.0
Mozambique	33,121	2,605	35,726	4.9
Netherlands	1,484,073	917,444	2,401,517	188.5
Netherlands Antilles	41,770	147	41,917	195.9
New Caledonia	3,823	349	4,172	43.5
Niger	3,062	96	3,158	0.8
Nigeria	75,286	2,152	77,438	1.2
Norway	771,118	94,692	865,810	226.7
Papua and New Guinea	11,110	436	11,546	5.0
Peru	583,385	11,066	594,451	46.5
Philippines	5,584,796	2,033	5,586,829	155.7
Polynesia, French	2,764	180	2,944	29.4
Portugal	656,736	54,079	710,815	75.1
Puerto Rico	410,822	12,090	422,912	155.3
Réunion	5,564	543	6,107	14.2
Ryukyu Islands	146,313	2,973	149,286	153.1
Sarawak, East Malaysia	23,639	1,529	25,168	27.1
Sénégal	16,806	1,704	18,510	5.0
Singapore	423,793	1,477	425,270	213.9
South Africa	1,913,444	103,176	2,016,620	106.4
South West Africa	18,737	6,948	25,685	42.5
Swaziland	966	185	1,151	29.1
Sweden	4,242,000	714,000	4,956,000	624.0
Switzerland	926,370	1,037,139	1,963,509	319.4
Tanzania	3,289	1,376	4,665	3.7
Thailand	182,006	2,225	184,231	5.5
Trinidad and Tobago, W. I.	121,525	19,006	140,531	137.6
Turkey	490,468	29,815	520,283	15.5
United Kingdom	7,483,000	1,211,000	8,694,000	157.3
United States	134,766,000	6,189,000	140,955,000	701.0
Viet-Nam, Republic of	44,475	449	44,924	2.6

Countries which have 500,000 or more telephones

Data are at January 1

COUNTRY	TOTAL TELEPHONES IN SERVICE: NUMBER 1969	1968	1959	Per Cent Increase from 1968	Per Cent Increase from 1959	Per 100 Population	AUTOMATIC: Number	Per Cent of Total
Argentina	1,599,861	1,553,281	1,223,509	3.0	30.8	6.72	1,464,862	91.6
Australia	3,392,436	3,178,278	2,056,000	6.7	65.0	28.20	2,985,633	88.0
Austria	1,242,785	1,163,194	615,328	6.8	102.0	16.88	1,225,480	98.6
Belgium	1,847,363	1,753,698	1,036,305	5.3	78.3	19.18	1,825,020	98.8
Brazil	1,560,701	1,472,677	949,306	6.0	64.4	1.74	1,326,596	85.0
Canada	8,820,770	8,385,476	5,118,293	5.2	72.3	42.12	8,641,465	98.0
Colombia	574,700 (Est.)	524,824	243,986	9.5	135.5	2.85	556,310	96.8
Czechoslovakia	1,789,373	1,678,717	889,684	6.6	101.1	12.44	1,642,320	91.8
Denmark	1,516,802	1,469,195	976,667	3.2	55.3	30.88	1,293,860	85.3
Finland	1,009,336	949,976	545,338	6.2	85.1	21.50	910,807	90.2
France	7,503,491	6,999,621	3,703,578	7.2	102.6	14.98	5,859,733	78.1
Germany, Eastern	1,896,151	1,780,319	1,175,131	6.5	61.4	11.10	1,896,151	100.0
Germany, Western	11,248,979	10,321,281	5,090,102	9.0	121.0	18.65	11,248,979	100.0
Greece	761,550	660,129	168,993	15.4	350.6	8.63	740,032	97.2
Hungary	684,389	634,527	400,972	7.9	70.7	6.66	530,435	77.5
India	1,057,193	993,590	378,496	6.4	179.3	0.20	782,727	74.0
Italy	7,752,042	7,057,187	3,182,455	9.8	143.6	14.37	7,751,745	100.0
Japan	20,525,211	18,216,767	5,096,296	12.7	302.7	20.12	16,981,770	82.7
México	1,174,943	1,044,415	447,984	12.5	162.3	2.44	1,081,411	92.0
Netherlands	2,917,384	2,715,635	1,402,155	7.4	108.1	22.80	2,917,384	100.0
New Zealand	1,155,465	1,119,422	641,342	3.2	80.2	41.56	974,635	84.4
Norway	1,036,027	987,292	683,075	4.9	51.7	27.02	841,984	81.3
Poland	1,650,896	1,530,479	732,682	7.9	125.3	5.08	1,418,396	85.9
Portugal	653,407	615,965	332,309	6.1	96.6	6.87	533,788	81.7
Rumania	596,000 (Est.)	551,820	261,700	8.0	127.7	2.99	476,800	80.0
South Africa	1,397,725	1,322,101	887,601	5.7	57.5	7.29	1,069,476	76.5
Spain	3,723,239	3,378,865	1,490,151	10.2	149.9	11.44	3,019,959	81.1
Sweden	4,110,579	3,934,694	2,526,424	4.5	62.7	51.76	4,090,185	99.5
Switzerland	2,685,800	2,533,684	1,475,003	6.0	82.1	43.42	2,685,800	100.0
United Kingdom	12,901,000	12,099,000	7,525,000	6.6	71.4	23.26	12,657,000	98.1
U.S.S.R.	9,900,000 (Est.)	9,100,000	3,810,000	8.8	159.8	4.14	7,326,000	74.0
United States	109,256,000	103,752,000	66,645,000	5.3	63.9	54.02	109,178,000	99.9
Yugoslavia	549,019	506,039	217,542	8.5	152.4	2.70	525,219	95.7

COUNTRY	MAIN: Number	Per Cent of Total	EXT. & P.B.X.: Number	Per Cent of Total	BUSINESS: Number	Per Cent of Total	RESIDENCE: Number	Per Cent of Total	Extension as % of Main
Argentina	1,255,683	78.5	344,178	21.5	662,512	41.4	937,349	58.6	10.0
Australia	2,386,595	70.4	1,005,841	29.6	n.a.	—	n.a.	—	—
Austria	831,032	66.9	411,753	33.1	n.a.	—	n.a.	—	—
Belgium	n.a.	—	n.a.	—	n.a.	—	n.a.	—	—
Brazil	n.a.	—	n.a.	—	n.a.	—	n.a.	—	—
Canada	6,097,930	69.1	2,722,840	30.9	2,557,150	29.0	6,263,620	71.0	19.5
Colombia	n.a.	—	n.a.	—	n.a.	—	n.a.	—	n.a.
Czechoslovakia	875,287	48.9	914,086	51.1	1,314,480	73.5	474,893	26.5	n.a.
Denmark	1,130,705	74.5	386,097	25.5	n.a.	—	n.a.	—	n.a.
Finland	679,772	67.3	329,564	32.7	n.a.	—	n.a.	—	n.a.
France	3,683,908	49.1	3,819,583	50.9	n.a.	—	n.a.	—	n.a.
Germany, Eastern	859,790	45.3	1,036,363	54.7	n.a.	—	n.a.	—	n.a.
Germany, Western	6,757,254	60.1	4,491,725	39.9	n.a.	—	n.a.	—	—
Greece	646,845	84.9	114,705	15.1	n.a.	—	n.a.	—	—
Hungary	354,965	51.9	329,424	48.1	472,121	69.0	212,268	31.0	—
India	773,117	73.1	284,076	26.9	n.a.	—	n.a.	—	—
Italy	5,587,494	72.1	2,164,548	27.9	3,236,457	41.7	4,515,585	58.2	12.7
Japan	15,176,715	73.9	5,348,496	26.1	13,408,545	65.3	7,116,656	34.7	3.4
México	643,358	54.8	531,585	45.2	641,347	54.6	533,596	45.4	43.5
Netherlands	1,863,591	63.9	1,053,793	36.1	n.a.	—	n.a.	—	—
New Zealand	783,030	67.8	372,435	32.2	423,844	36.7	731,621	63.3	13.5
Norway	642,536	62.0	393,491	38.0	455,851	44.0	580,176	56.0	n.a.
Poland	901,388	55.2	749,508	45.4	1,144,399	69.3	506,557	30.7	n.a.
Portugal	475,491	72.8	177,916	27.2	n.a.	—	n.a.	—	n.a.
Rumania	n.a.	—	n.a.	—	n.a.	—	n.a.	—	n.a.
South Africa	901,015	64.5	496,710	35.5	773,863	55.4	623,862	44.6	n.a.
Spain	2,323,725	62.4	1,399,514	37.6	2,419,171	65.0	1,304,068	35.0	13.2
Sweden	3,112,927	75.7	997,652	24.3	1,204,579	29.3	2,906,000	70.7	2.9
Switzerland	1,736,398	64.7	949,402	35.3	1,396,616	52.0	1,289,184	48.0	n.a.
United Kingdom	7,297,000	56.6	6,604,000	51.2	6,759,000	52.4	6,142,000	47.6	14.5
U.S.S.R.	n.a.	—	n.a.	—	n.a.	—	n.a.	—	n.a.
United States	64,406,000	58.9	44,850,000	41.1	30,407,000	27.8	78,849,000	72.2	43.6
Yugoslavia	n.a.	—	n.a.	—	n.a.	—	n.a.	—	—